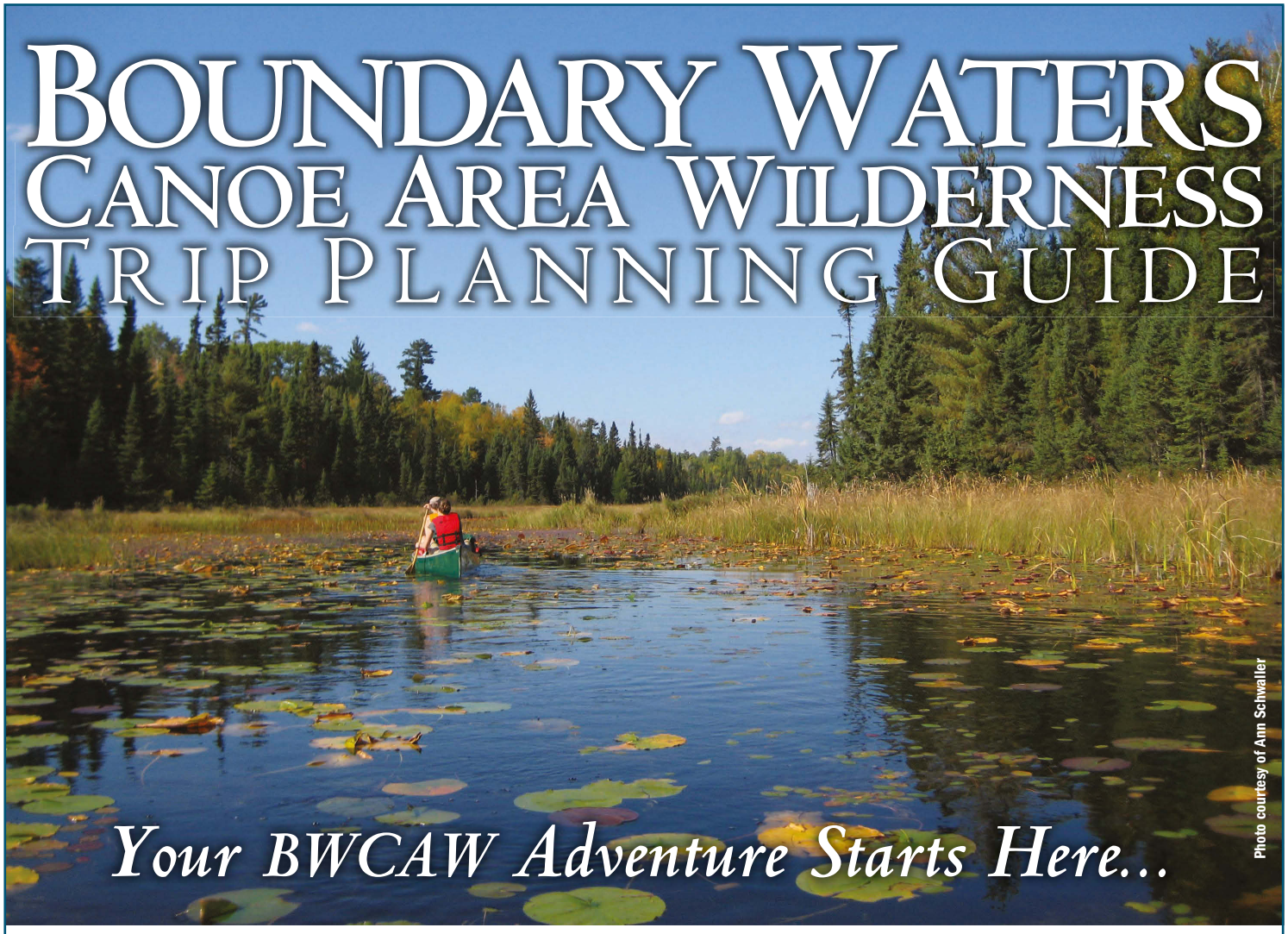
USDA

United States Department of Agriculture

Boundary Waters Canoe Area Wilderness Trip Planning Guide



Your BWCAW Adventure Starts Here...

Great glaciers carved the physical features of what is today known as the Boundary Waters Canoe Area Wilderness (BWCAW) by scraping and gouging rock. The glaciers left behind rugged cliffs and crags, rocky shores, sandy beaches and thousands of lakes and streams, interspersed with islands and surrounded by forest.

The BWCAW is a unique area located in the northern third of the Superior National Forest in northeastern Minnesota. Over 1,098,000 acres in size, it extends nearly 150 miles along the International Boundary adjacent to Voyageurs National Park and Canada's Quetico and La Verendrye Provincial Parks. The BWCAW contains over 1,200 miles of canoe routes, 12 hiking trails and over 2,000 designated campsites. This area was set aside in 1926 to preserve its primitive character and made a part of the National Wilderness Preservation System in 1964 with subsequent legislation in 1978.

Designated wilderness offers solitude, freedom, primitive recreation, challenge, risk, and personal connection with nature. The BWCAW allows visitors to canoe, portage and camp in the spirit of those travelers that came before them centuries ago.

What's Inside

EXHIBIT 1

Plan Your BWCAW Trip

Successful wilderness trips don't just happen. They are the result of careful planning. Please use this trip planning guide to get started. However, we suggest that you also use guidebooks and maps found in bookstores, local libraries, online and at outdoor equipment stores. The expertise of outfitters and guides can also be used when planning a BWCAW trip (see page 24).

As you begin to plan your trip, ask yourself about the type of experience you seek. Would your needs for solitude or your quest for the elusive lake trout best be met inside the BWCAW, or would camping in areas of the Forest adjacent to the BWCAW better suit the needs of your group? The BWCAW is only one of many recreation alternatives on the Superior National Forest.

Recreation Alternatives in the Superior National Forest

Backcountry Campsites

There are 254 backcountry campsites outside the wilderness that offer remote paddling, camping and fishing. Here you can experience solitude without reservations, fees or permits and still have a fire grate and latrine. Visitors must follow the same Leave No Trace principles listed on page 5. For a list of canoe routes with backcountry campsites go to: ***www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5302434.pdf***

Forest Campgrounds

The Forest has 23 developed campgrounds open from mid-May to mid-September. Campground facilities vary from flush toilets and showers at fee campgrounds, to "rustic" campgrounds with vault toilets and water pumps with no fees. Rustic campgrounds are available first come, first served year-round. Each campsite has a picnic table, fireplace, tent pad and parking. Reservations may be made for some fee campgrounds by calling (877) 444-6777 or at: ***www.recreation.gov***

Resorts & Private Campgrounds

Near the Forest are a variety of private resorts and campgrounds that suit the needs of visitors looking for a trip near the wilderness rather than in it. See tourism information on page 24.

Day Trips into the BWCAW

Non-motorized day trips by canoe, kayak, standup paddleboard or hiking require a Self Issued permit available at entry point kiosks. No reservations or fees are required for non-motorized day trips. See page 3 for details.

Accept the Wilderness Stewardship Challenge

Accepting the wilderness challenge comes with great responsibility. Wilderness recreation inside the BWCAW requires careful planning, preparation and involves some risk. Wilderness travel offers great personal freedom, but also requires self-reliance and good judgement. The visitor must have knowledge of the entry points and routes; and some research may be needed to gather this information. Each step in the planning process is necessary in order to protect the BWCAW and to provide a quality wilderness experience. Permits are always required to enter the BWCAW (see page 3).

Wilderness visitors face inherent risk of adverse weather conditions, isolation, physical hazards and lack of rapid communications. Do not rely on a search and rescue, it may not be possible. Be prepared! Prevent the need for a search and rescue operation that may impact the integrity of the wilderness area or put lives in danger. It is your responsibility to acquire and maintain necessary skills for primitive travel by foot, canoe or other non-mechanical means.

If you lack the appropriate skills for remote backcountry travel, consider using a professional guide (see page 24).

***You* are responsible for your own safety and that of your group.**

Before You Leave Home

Check current Minnesota Department of Natural Resources (MN DNR) fishing, hunting and watercraft regulations before your trip including:

- Canoe, kayak, standup paddleboard and watercraft registrations
- Fishing licenses and trout stamps
- Fishing limits and possession of fish
- Hunting seasons
- Watercraft lights

For more information, contact the MN DNR: 888-646-6367
www.dnr.state.mn.us/regulations

Trip Itinerary

Always leave a trip itinerary with someone before leaving home! See sample trip itinerary on page 23.

Bring survival gear to prevent becoming injured or lost:

- Map
- Compass
- Rain gear
- Signaling mirror
- Fire starter
- Extra food
- Warm clothing
- Whistle
- Nylon cord
- Folding knife
- Water proof pouch
- Emergency blanket
- Sleeping bag and tent
- Water filter or purifier
- First aid kit and necessary medications
- Weather radio

Wilderness Permits: the Basics

Permits are required year-round for all visitors to the Boundary Waters Canoe Area Wilderness (BWCAW). Please use the following information to help you determine which type of permit is appropriate for your group.

Quota Permits

Quota permits are required for any group entering the BWCAW between May 1 and September 30 if they are camping overnight (whether the group is paddling, motoring or hiking) or if they are visiting during the day using a motorized boat. The quota system regulates how many groups may enter an entry point each day.*

In addition to daily quotas, motorized use is limited by a weekly motor quota. Groups may only enter the BWCAW on the entry date and through the entry point specified on the permit. Permits may only be picked up the day before or on the date specified on the permit. Permits may not be transferred to someone not listed on the permit. Reservations are recommended since there is a limited number of quota permits available for each entry point.

Quota permits are issued only at Forest Service permit issuing stations and cooperating businesses under a Cooperator Agreement.

First Come, First Served

All permits for all entry points will be released on a first come, first served basis beginning at 9:00 a.m. Central Time on the last Wednesday in January through ***www.recreation.gov*** or through the reservation center at: 877-444-6777.

Visitors will see available entry points and dates, and make a reservation instantly for the permit that best meets their needs. A $6.00 non-refundable reservation fee is charged for each permit reserved. The entry point, entry date, group leader and alternates cannot be changed after the reservation is complete. The exit date, issuing station and group size may be changed.

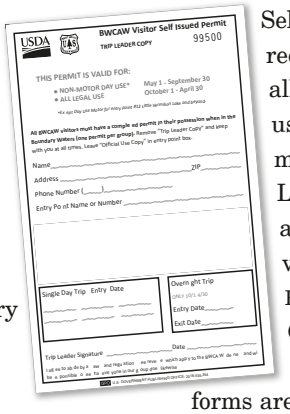
*Some exclusions apply

Photo courtesy of Robert McAdams

One Permit Per Day

One permit per day, per permit holder: To ensure everyone has the opportunity to make a reservation, be aware that when a visitor makes multiple reservations on the same entry date or has overlapping reservations, all but one permit will automatically be cancelled by the Forest Service. Cancelled permits will be returned to the inventory.

Non-Quota Self Issued Permits


BWCAW Visitor Self Issued Permit
TRIP LEADER COPY
99500
THIS PERMIT IS VALID FOR:
• NON-MOTOR DAY USE* May 1 - September 30
• ALL LEGAL USE October 1 - April 30
Name
Address
ZIP
Phone Number ( )
Entry Point Name or Number
Single Day Trip Entry Date
Overnight Trip
Entry Date
Exit Date
Trip Leader Signature
Date

Self Issued permits are required year-round for all non-motorized day use visitors, for any motorized day use into Little Vermilion Lake, and for all overnight visitors entering the BWCAW between October 1 and April 30. The Self Issued forms are available at any Superior National Forest Office and at entry point kiosks. No quota is applied to this use, so no reservations are needed.

"In the wild world, relationship is evolutionary, time is geologic, beauty is intelligent. There we find ourselves under a powerful spell."

— Janisse Ray

Please fill out the form carefully and review the rules on the back of the permit with your entire group. Carry the top copy of the permit with you at all times and place the duplicate copy in the box at the entry point or drop it off at the nearest Forest Service office when you return.

Special Use Permits

Outfitters and guides leading groups into the BWCAW must obtain a special use permit and must follow all the same Regulations and Rules (see page 21).

User Fees

User fees are charged for all overnight visitors to the BWCAW between May 1 and September 30. There are no user fees for day use visitors. Fees are as follows:

User Fees Per Person Per Trip

Adult	$16.00
Youth (0-17)	$8.00
Interagency Senior/ Access Card Holders	$8.00
Youth Access Card Holders	$4.00

"Wilderness itself is the basis of all our civilization. I wonder if we have enough reverence for life to concede to wilderness the right to live on?"

— Margaret (Mardy) Murie

Overnight User Fee Deposit

When making advanced reservations, you will be charged a minimum of 2 adult overnight user fees. You will also have the option to pay for the entire group as well as changing the group size within a one day window prior to your entry date. If cancelled outside the 2-day window, the card holder will be fully refunded. If cancelled within the 2-day window, $32.00 for 2 adults is retained and additional payments will be refunded. The Forest Service will retain the entire payment if the group is a no show. A new confirmation will be emailed each time a change is made. Adjustments to group sizes will be made at the permit issuing station as needed.

Permit Issuing Station

When reserving a permit, the default issuing station will be the Forest Service (FS) Office responsible for that entry point. You may choose a cooperating business as a permit issuing station. Businesses are often open earlier and later than FS stations. See the list of permit issuing stations on page 24 of this brochure. Hours and contact information of the issuing station will be listed on your confirmation email. You may want to confirm dates, hours and location ahead of time. You may change your issuing station through your recreation.gov account.

Picking Up A Permit

Permits can only be picked up the day before or the day of entry. Please check with your desired permit pick-up location to confirm their office hours. Remember to bring a photo ID when you pick up your permit.

Reserved Permits

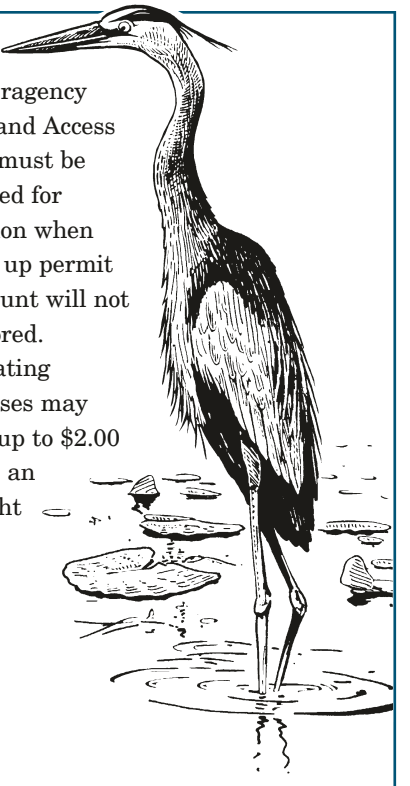
Permits may only be picked up the day before or on the date of entry from a permit issuing station by a group leader or alternate listed on the permit. Alternates cannot be added after a permit is reserved. Listing alternates gives your group options if the group leader must miss the trip. Remember to bring a photo ID with you. The person signing the permit must be with the group the entire trip. If your group size changes, additional user fees will be collected or a refund will be credited to the credit card used to pay for the reservation.

Non-Reserved Permits

Walk-up permits for any entry point with available quota may be obtained the day before or on the date of entry. User fees apply, and the $6 reservation fee will be charged.

Payment

Credit cards are the preferred method of payment at all permit stations. Cooperating businesses cannot accept cash or checks for user fees.



All Interagency Senior and Access Passes must be presented for validation when picking up permit or discount will not be honored. Cooperating businesses may charge up to $2.00 to issue an overnight permit.

Permit Reservations

Contact **Recreation.gov** to make your BWCAW permit reservation. Permits may be reserved online or by phone.

RESERVATION LINE

877-444-6777 Toll-Free
877-833-6777 TTY Relay Service
606-515-6777 International

WEBSITE RESERVATIONS

www.recreation.gov

Boundary Waters Canoe Area Wilderness Dark Sky Sanctuary

The BWCAW is the first and largest federally designated wilderness to be so named, a certification granted by the International Dark Sky Association, a non-profit founded to reduce light pollution and protect the night skies.

Protect the Dark Sky Sanctuary!

- The BWCAW has an exceptional quality of starry nights and a nocturnal environment worth protecting for visitors and wildlife.
- Use minimal lighting while camping. Refrain from using perimeter or flood lights.
- Learn more about the International Dark Sky Association: **www.darksky.org**

Preserve the night sky where you live:

- Use outdoor lighting only when and where needed.
- Utilize fully shielded light fixtures outdoors.
- Minimize blue light emissions by using amber.
- Close blinds at night to keep indoor light inside.
- Look for the IDA fixture seal of approval when buying lights: **www.darksky.org/our-work/lighting/lighting-for-industry/fsa/**

ida INTERNATIONAL DARK-SKY ASSOCIATION

BWCAW DARK SKY SANCTUARY · SUPERIOR NATIONAL FOREST

Leave No Trace Principles

LEAVE NO TRACE

The Leave No Trace Principles of outdoor ethics form the framework of the BWCAW Regulations and Rules:

The BWCAW is legendary in its richness and complexity. It exerts an ageless draw upon people who seek adventure, refreshment and the exhilaration of outdoor recreation. But, as these wildlands host more and more visitors, our collective mark on the environment has become apparent — and more damaging. Water pollution, litter and disturbance to vegetation and soil, wildlife and other recreating visitors are indicators of the need to protect these wild and serene waters and forests, and their inhabitants.

There are far more of us pushing our outdoor activities to greater extremes and into the remotest parts of the natural world everyday. Our mere presence in wildlands has an influence. Destruction can be prevented if visitors are better informed about low impact techniques. To insure the continued existence of the places and wildlife that inspire us, we must educate ourselves and adopt the skills and ethics that enable us to Leave No Trace. For more information on becoming LNT savvy, visit: ***www.lnt.org***

Plan Ahead & Prepare

- Know area Regulations and Rules.
- Prepare for extreme weather.
- Use a map and compass.
- Reduce litter from the source — repackage food into reusable plastic bags or containers and remove excess packaging. Unwrap snack foods at home and bag them in bulk.

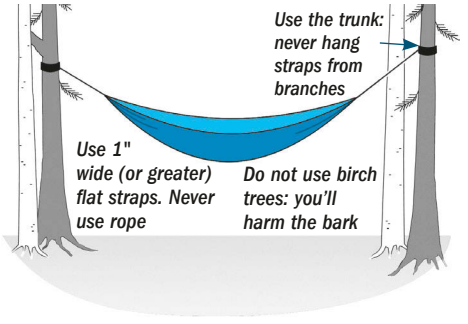
Minimize Campfire Impacts

- Use a lightweight stove for cooking.
- When fires are permitted, use an established fire grate and keep fires small.
- Burn all wood and coals to ash, and make sure the fire is completely out.
- Even after forest fires, you may see an ample supply of burned wood near your site. Collect firewood well away from campsites to prevent enlarging and defacing the area and depriving the soil of nutrients.
- Use only dead and downed wood easily broken by hand and smaller than your wrist.
- Damaging any living plant is illegal. Peeling birch bark, carving, nailing or chopping roots kills the trees. Never cut live vegetation!

Travel & Camp on Durable Surfaces

- Durable surfaces include established trails and campsites, rock, gravel, dry grasses or snow.
- Keep campsites small — stay in area where vegetation is absent and don't enlarge the campsites.
- Walk in single file in the middle of the trail even when the trail is muddy.

Using a Hammock?



- Select thick-barked trees that have a trunk diameter of at least 8 inches.
- Do not use birch trees for hammocks. It harms the bark.
- Hang from flat straps which are 1" or greater in width or manufactured for hammock use. Never use rope even if it came with the hammock.
- Only use the trunk of the tree, do not hang straps from branches. Never remove branches from a live or dead standing tree!
- Protect vegetation by hanging your hammock in a place that has already been impacted or has a durable surface such as bedrock below.

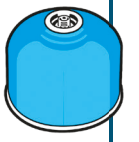
Dispose of Waste Properly

- Pack out all trash, leftover food & litter.
- Latrines are not garbage cans! Trash in the latrine harms wildlife. Deposit only human or dog waste in the latrine.
- Preserve water quality, wash at least 200 feet from shore — soil filters dirty water and breaks down bacteria. Use soap and other products sparingly, they are not biodegradable.
- Burning trash in firegrates is illegal and it pollutes the air and soil.
- Personal waste items such as cigarettes, cotton swabs, grease, wipes, paper towels, bandages, diapers, condoms, plastic baggies and female products (tampons and pads), should always be packed out.

Leave What You Find

- Do not take cultural or historical artifacts or structures.
- Do not introduce or transport non-native plants, live bait or animals.
- Do not take rocks, plants and other natural objects such as antlers.

Disposing of Propane Cylinders



- Contact your local liquid propane (LP) supplier about refilling and recycling empty LP cylinders.
- To prevent waste, consider a stove that uses refillable liquid fuel canisters.

Be Considerate of Others

- Let nature's sounds prevail. Human noise has a significant effect on solitude, especially in water-based wilderness areas where sound carries long distances over water. When noise squelches natural sounds, animals and humans suffer.
- Avoid playing music, yelling, banging pots, dragging canoes over rocks, and singing loudly especially in the morning and evening.
- Take breaks away from trails, portages and other visitors.
- Do not take campsites for day use.

Respect Wildlife

- Do not follow or approach wildlife.
- Never feed animals. It can damage their health and alters wild behaviors.
- Protect wildlife. Store rations properly.
- Use lead-free tackle.

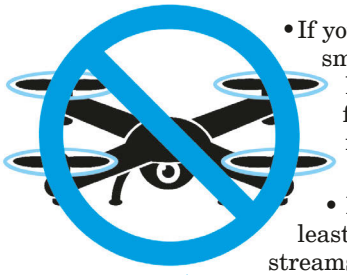
Preserve the Night Sky

- Use minimal lighting while camping.
- Refrain from using perimeter, flood lights or hanging string lights.

BWCA Wilderness Regulations & Rules

The following are enforceable Forest Service regulations (maximum penalty of $5,000 and/or 6 months in jail).

Drone Free Zone



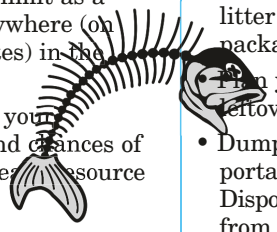
- Drone operation is prohibited in the BWCA Wilderness.
- Violations punishable under federal law Executive Order 10092 and 36 CFR 261.18(a).

Travel Permits

- You must enter the BWCAW at the entry point and on the entry date shown on your permit.
- You may not re-enter on a different date using the same permit.
- Permit stubs become invalid when the group leader exits the wilderness.
- The person signing for and picking up the permit can only be responsible for one group during the specified time on the permit.

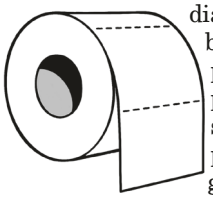
Group Size

- Nine (9) people and four (4) watercraft are the maximum allowed together in the wilderness.
- You may not exceed the limit as a group at any time or anywhere (on water, portages, campsites) in the BWCAW.
- Smaller groups enhance your wilderness experience and chances of seeing wildlife, and decrease resource impacts.



Toilet Facilities & Water Quality

- Use wilderness latrines at designated campsites.
- Wilderness latrines are not garbage cans and should be used for the intended purpose only. Personal waste items such as cigarettes, cotton swabs, grease, wipes, paper towels, bandages, diapers, condoms, plastic baggies and female products (tampons, pads and applicators), should always be packed out and never go into the latrines.



Personal waste in latrines prevents decomposition of bodily waste making latrines ineffective and can contaminate surrounding water. Remember all trash must be packed out.

- If you're not near a latrine, dig a small hole 6–8 inches deep at least 200 feet* or more back from the water's edge. When finished, fill hole and cover with needles and leaves.
- Bathe and wash dishes at least 200 feet from lakes and streams.
- All soaps pollute water including soaps labeled "biodegradable." Always remember the visitors that come after you and the water they will drink.

Containers

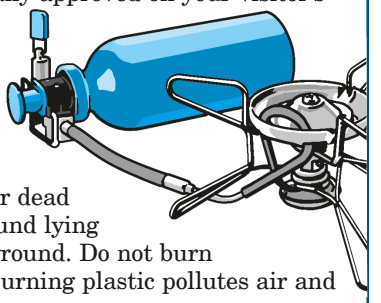
- Possessing any cans or glass bottles is illegal, except containers of fuel, insect repellent, or medicines.
- Carry food and drinks only in containers designed and intended for repeat use to prevent more trash.

Food, Fish Remains & Live Bait

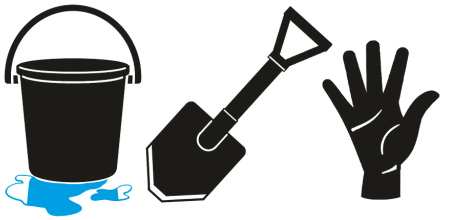
- When preparing for your trip, reduce litter at the source by minimizing packaging.
- Plan your meals so you don't have leftovers. If you do, pack them out.
- Dump bait bucket water before every portage and refill on the other side. Dispose of fish remains at least 200 feet* from shorelines, campsites, trails, and portages. MN state law prohibits dumping unused bait into water, pack it out.
- Dumping bait on the ground is considered littering. Therefore, unwanted live bait should be packed out with you and placed in the trash, disposal bins or compost bins.

Campfires

- Due to potential fire danger, fire restrictions may be put into effect. Check on current conditions just prior to your trip. You may be required to use a camp stove if there is a campfire restriction.
- Bringing a small camp stove is a good idea because it heats food more quickly, has less impact than a fire, and comes in handy during rainy weather.
- Fires are allowed within the steel fire grates at designated campsites or as specifically approved on your visitor's permit.



- If you build a fire, burn small diameter dead wood found lying on the ground. Do not burn trash. Burning plastic pollutes air and water.
- Collect firewood well away from campsites by paddling down the shore and walking into the woods where it is more abundant.
- Dead and downed wood easily broken by hand or cut with a small folding saw eliminates the need for an axe. Never cut a live tree!
- Transporting wood from out of state is prohibited due to the spread of tree diseases and pests.
- Drown your fire with water any time you are going to be away from your camp or at bedtime. Stir the ashes until they are cold to the touch.



Drown! **Stir!** **Cold to the touch!**

Campsites

- All members of a permit group must camp together. Only one campsite per group.
- During ice free season, camp only at Forest Service designated campsites that have steel fire grates and wilderness latrines. For winter camping, see page 11.
- When in a busy area, travel further in and away from the periphery if capable.
- It is illegal to cut, hack or deface live vegetation for any reason.
- You may camp up to fourteen (14) consecutive days on a specific site.

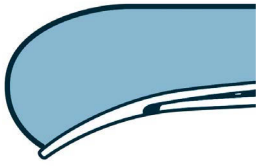
200 feet is approximately 70 big steps for adults and 120 for kids!

"In my opinion, camping can be the greatest expression of free will, personal independence, innate ability, and resourcefulness possible today in our industrialized, urbanized existence."

— Anne LaBastille

Storing Watercraft

- Only watercraft and equipment used in connection with your current visit may be stored and left unattended.
- All equipment and personal property must be carried out with you at the end of each trip.



Cultural Heritage

- Leave archaeological, historical and rock painting sites undisturbed.
- The use of metal detectors is prohibited.

Firearms & Fireworks

- Discharging a firearm is prohibited within 150-yards of a campsite or occupied area, or in any manner or location that places people or property at risk of injury.
- Firearm and game laws apply in the BWCAW.
- Fireworks of any kind are illegal.

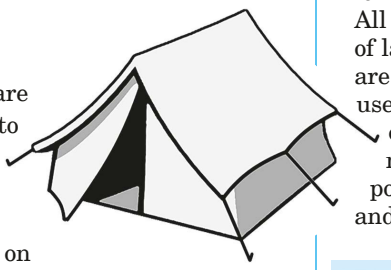
Pets

- Dogs endanger wildlife and barking intrudes on the experience of others.
- Dogs must be under human control at all times on a 6-foot or shorter leash.
- Dispose of dog waste 200 feet* from water sources, campsites and portages, or deposit it in a latrine.

Leave No Trace of your Visit

- After you break camp and load your watercraft, do a final inspection of your camp. Pick up any remaining litter.
- Your fire must be cold to the touch.
- Please treat the BWCAW with care. Leave no trace of your visit to protect this special place for future generations.

Hiking



- Trail users are encouraged to minimize impact by limiting use to one night on non-developed sites.
- You must camp more than 200 feet from a developed site or another group.

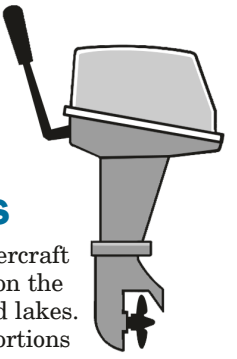
- You must camp at least 200 feet from any trail, portage, lake or other water source.

- Most importantly, be sure to use common sense and follow the safety guidelines recommended on page 8.

Wilderness permits are required year round for hiking in the BWCAW.

200 feet is approximately 70 big steps for adults and 120 for kids!

Motor-powered Watercraft Regulations



- Motor-powered watercraft are permitted only on the following designated lakes. All other lakes or portions of lakes within the BWCAW are paddle-only. Motors may not be used or be in possession on any paddle-only lake. No other motorized or mechanized equipment (including pontoon boats, paddle boats, sailboats and sailboards) is allowed.

Portage Wheels

Mechanical assistance is only permitted over the Four-Mile Portage, Fall-Newton-Pipestone and Back Bay Portages into Basswood Lake, Prairie Portage and Vermilion-Trout Lake Portage.

Lakes with 10 Horsepower (HP) Limit

On these lakes, the possession of one additional motor no greater than 6 HP is permitted, as long as motors in use do not exceed 10 HP:

- Clearwater, North Fowl, South Fowl, Seagull (no motors west of Three Mile Island), sections of Island River within the BWCAW.

Lakes with 25 HP Limit

On these lakes or portions of these lakes, the possession of one additional motor no greater than 10 HP is permitted, as long as motors in use do not exceed 25 HP:

- Basswood (except that portion north of Jackfish Bay and Washington Island), Saganaga (except that portion west of American Point), Fall, Newton, Moose, Newfound, Sucker, Snowbank, East Bearskin, South Farm, Trout.

Lakes with no HP Limits

- Little Vermilion, Loon, Lac La Croix (not beyond the south end of Snow Bay in the USA), Loon River.

Leave No Trace Video

Watch and share the ***BWCAW Leave No Trace User Education Video*** series with your group before you depart! Parts 1 & 2 include important trip planning information and should be viewed ahead of time. Part 3 will be shown when you pick up your permit. After viewing the videos, you will understand how to make a difference in the long-term health of the BWCAW by engaging in responsible recreation practices. This is an essential education tool in protecting the fragile wilderness ecosystem and providing a quality recreation experience for current and future generations. The BWCAW Leave No Trace User Education Video series may be accessed online at:

youtube.com/watch?v=nen7lRqEjm8

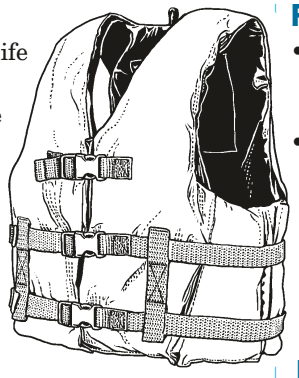
For information about reserving The BWCA Wilderness Education Kit, contact any Forest Service Office found on page 24 of this publication.

LEAVE NO TRACE

Smart & Safe Wilderness Travel

Wilderness travel offers great personal freedom, but requires self-reliance and good judgment. Use common sense and follow these safety tips for a safe BWCAW experience.

Life Jackets



- Always wear a life jacket.
- Minnesota state law requires all watercraft, including canoes, to have one wearable U.S. Coast Guard-approved personal flotation device (PFD) on board and readily accessible for each person in the watercraft.

Mandatory Child Life Jacket Law

- Minnesota law requires a life jacket to be worn by children less than 10 years old when aboard any watercraft while underway. For more on Minnesota state law, see: ***www.dnr.state.mn.us/safety/boatwater/index.html***

Rapids

- Running rapids in the BWCAW is not safe! ***Always*** use provided portages.
- Powerful currents can trap swimmers under water or sweep them towards dangerous waterfalls.
- Fast moving water can push swimmers and boats into rocks and logs.
- Even with life jackets on, rapids are dangerous.

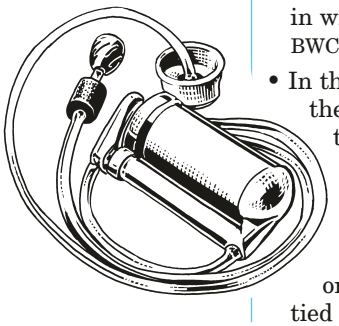
Water Quality

- ***Giardia lambia*** is a parasite that can cause an internal illness that will need medical attention.
- All drinking water should be treated by one of the following methods:

  1. Bring water to a full boil for 1 minute — then let stand until cool enough to drink.

  2. Purify with a filter specifically designed to remove Giardia lambia.

  3. Treat water with a chemical specifically designed to kill Giardia lambia.



Fish

- Chemicals such as mercury, PCBs and dioxin have been found in some fish from certain waters.
- Eat more pan fish and fewer predator fish, and trim the skin and fat to reduce your risk.
- Check with the Minnesota Department of Public Health for current information on limits of fish consumption at 651-201-4911.

Hypothermia

- A low body temperature can be serious, even fatal.
- Early warning signs are uncontrolled shivering, slurred speech, bluish tinge to lips, lack of coordination and poor concentration.
- To prevent hypothermia, layer clothing and get adequate food and water.
- To treat hypothermia, seek shelter from the wind, replace any wet clothing & share body heat if necessary.
- Give warm fluids if the person is conscious and have them rest until thoroughly warmed.

First Aid & Emergencies

- Each permitted group should carry a well stocked first aid kit and have group members that know how to provide first aid.
- Note the location of the lake, campsite, trail or portage on a map to help emergency people locate any seriously injured group members.
- Document the extent of the injury and a basic physical description of the injured person.
- Send all of this information with visitors able to exit the BWCAW for help.
- Do not rely on a cell phone. Having a cell phone cannot substitute for knowing how to handle an emergency in wilderness. Many areas of the BWCAW lack cell phone coverage.
- In the event of serious injury or illness, the standard SOS call is a series of three signals of any kind, either audible or visible.
  - For summoning help from an aircraft in an emergency, signal them by paddling in small circles or waving a brightly colored cloth tied to the canoe paddle.

Travel

- There are no directional signs in wilderness.
- A compass and accurate map are essential.
- Bring reliable maps. Maps can be purchased at some Forest Service offices, area businesses and outfitters, or directly from the map companies — see page 13 for details.
- If you get lost, don't panic. Sit down, relax and think. Chances are that you will figure out your location in a few minutes.
- If you plan to use a Global Positioning System (GPS) for navigating, be sure you also bring a map and compass as a back up in case your GPS unit fails.

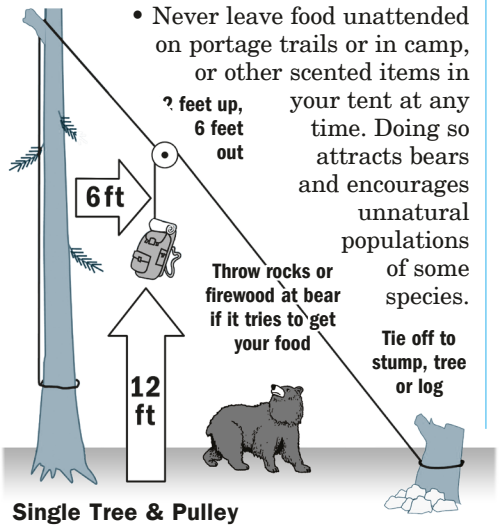
Weather

- Canoe close to shore. It lessens the chance of being endangered by sudden changes of weather. If a storm threatens, get off the water.
- Dress in layers and be prepared for every kind of weather situation.
- If in a lightning storm on the water, get to shore. If on land among trees of similar height, put yourself an equal distance between two trees. Avoid the tallest trees.
- Avoid being a bridge between an object and the ground. For example, do not lean against tent poles or trees.
- Avoid potential paths of conduction such as wet, lichen-covered rocks, cracks and crevices (wet or dry) and areas subject to the "spark gap" such as overhangs, wet ropes and tree roots.
- If your skin tingles, or your hair stands on end, stand on a life jacket or sleeping bag, squat low to the ground on the balls of your feet.
- Place your hands on your knees with your head between them. Make yourself the smallest target possible, and minimize your contact with the ground.
- When camping, hiking or paddling in high winds, be mindful of safety concerns including worsening weather, high waves, possible blowdown, etc.

Dehydration

- The body becomes dehydrated when more fluids are lost than replaced.
- Drink plenty of water throughout the day.
- Signs of dehydration include headache, cold and flu symptoms, and infrequent urination.

Bear Awareness & Food Storage



Single Tree & Pulley

Pulleys make pack hanging easier on trees and campers.

- Never leave food unattended on portage trails or in camp, or other scented items in your tent at any time. Doing so attracts bears and encourages unnatural populations of some species.
- Some bears overcome their fear of humans and approach campsites looking for food. This includes island sites since bears are good swimmers.
- If you do encounter a bear, most will be scared off if you make noise (shout, bang pots or throw fist-sized rocks at the bear, etc.).
- A very persistent bear may be discouraged by spraying pepper spray into its eyes.
- Use a bear-resistant container or ropes to hang food packs. Learn about approved bear-resistant products, visit ***igbconline.org***.

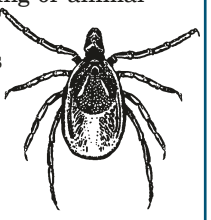
bear-resistant container

Ticks Can Spread Disease, Including Lyme Disease.

Most tick bites do not result in disease, but it is a good idea to recognize and watch for the early symptoms of some of the more commonly encountered tick-transmitted diseases.

Where can I be infected?

Ticks are found in wooded or brushy areas, on the edge of hiking or animal trails, or on the edge of a field where it meets a wooded or brushy area. They are in the BWCAW.



Protect yourself:

- Use insect repellent that contains 20 – 30% DEET. Natural oils such as geranium, lavender, lemongrass, citronella, eucalyptus and cedar wood can repel ticks as well. No campsite insect foggers.
- Wear clothing that has been treated with permethrin.
- Look for ticks on your body. Ticks can hide under the armpits, behind the knees, in the hair and in the groin.
- See a doctor if you develop a fever, rash, severe fatigue, facial paralysis or joint pain. For more information visit: ***www.cdc.gov/Lyme or: www.health.state.mn.us/diseases/tickborne/ticks.html***

Travel to Quetico Provincial Park

Entry Into Canada

If your trip to the BWCAW will include entry into Canada, you should contact the Canadian Border Services Agency at least 6-8 weeks in advance of your trip to obtain a *Remote Area Border Crossing* (RABC) permit. To apply for a RABC Program permit, you must be a citizen or permanent resident of Canada or the United States. To learn more about RABC permits including eligibility, documents, fees and applications, visit: ***www.cbsa-asfc.gc.ca/prog/canpass/rabc-pfre/menu-eng.html***

Permits for Quetico Provincial Park are required for overnight and day use entry. Please visit ***www.ontarioparks.com*** for permit information.

Fishing In Canada

If you plan on fishing in Canada, including the Canadian side of the border lakes, you must have an Outdoors Card and/or Canadian fishing license. Non-resident fishing licenses are available online or by calling the Ontario Ministry of Natural Resources at 1-800-288-1155. For more information visit: ***www.ontario.ca/page/fishing***

Entry Into The U.S. From Canada

U.S. citizens can present a valid U.S. Passport, Passport Card, Enhanced Driver's License, Trusted Traveler Program card (NEXUS, SENTRI or FAST), or Form I-872 American Indian Card or (when available) Enhanced Tribal Card. Canadian citizens can present a valid passport, Enhanced Driver's License or Trusted Traveler Program card (NEXUS, SENTRI or FAST). U.S. and Canadian citizen children under the age of 16 (or under 19, if traveling with a school, religious group, or other youth group) need only present a birth certificate or other proof of citizenship. The birth certificate can be original, photocopy or certified copy.

If you enter the United States from Canada on your BWCAW trip, you must report to a Customs Border Protection (CBP) officer for inspection at a port of entry or a designated inspection location every time you enter the U.S. from Canada by boat. Alternatively, the CBP Reporting Offsite Arrival — Mobile(ROAM) application can be used by boaters to check-in remotely. Download the CBP ROAM™ app prior to departure-from the Apple App Store or the Google Play Store and visit the U.S. Customs and Border Protection website for more information: ***https://www.cbp.gov/travel/pleasure-boats/pleasure-boat-overview/roam*** For further questions about crossing the U.S./Canadian border, please call a local port of entry: (218) 283-2541 (International Falls) or (218) 475-2244 (Grand Portage).

Recreation Alternatives on Crown Land

For information about camping and recreation on Ontario's Crown land outside of provincial parks and conservation reserves, please visit: ***https://www.ontario.ca/page/recreational-activities-on-crown-land***

BWCAW Permits for Travel To/From Canada

When your trip includes travel to or from Canada, select Paddle to/from Canada or Motor to/from Canada for the permit type when reserving your BWCAW permit online at ***Recreation.gov.***

Quetico Provincial Park:

807-597-2735 Park Headquarters • 888-668-7275 Reservation Line • www.ontarioparks.com
www.ontarioparks.com/park/quetico/alerts

Camping and Fire

Did you know that 50% of wildfires in the BWCAW are caused by escaped campfires? To help reduce wildfire risk in the BWCAW, choose a camp stove instead of a campfire. If a campfire is allowed, build it in the fire grate and keep it small. Like a candle in your home, never leave a fire unattended at any time. Keep all flammable materials away from your campfire.

Always make sure your campfire is dead out before leaving your campsite, even for a short time. Drown your fire with water, extinguishing all embers, leaving it cold to the touch.

Watch For Hazards

Keep a heads up! Weakened trees (even when green) can still pose a hazard during high winds. Avoid camping around or under damaged or leaning trees. Root wads above ground may also be unstable and dangerous.

Know About Campfire Restrictions

Restrictions are implemented during high fire danger to decrease the threat of unwanted wildfires. Fire restrictions are put in place for your safety and the safety of firefighters. Always check for potential restrictions just prior to your trip. Camp stoves may be required if restrictions are implemented. For current fire restriction information contact any Superior National Forest Office (see page 24), or check our website for Fire Alerts: *www.fs.usda.gov/superior*

Your Permit Reservation

If an entry point is closed and alternates are not available, reservation and user fees will be refunded. If the entry point is not closed and you choose not to use your reservation because there is a fire, you will not be refunded the reservation fee and user fees may be retained if inside the cancellation window.

If You See Or Smell Smoke, Don't Panic

Do pay attention! Steps may be taken to reduce your risk.

Courtesy of Tom Kaffine

If you encounter a wildfire as you travel in the BWCAW, follow these steps:

1. Watch The Weather

Wind — Most fires travel with the prevailing wind in our area. Have a safe route to follow if wind direction changes. Keep in mind that strong winds can carry fire embers causing spot fires ahead of the original fire.

Evening Humidity — Consider that humidity typically increases in the early morning and late evening. Fire activity may decrease with higher humidity.

Tall Smoke Plumes — If you see or experience a large smoke plume close to you, take precaution; seek a point of refuge such as a lake, and be prepared for resulting high wind and waves.

2. Make A New Plan

Look at alternate travel routes staying close to larger bodies of water. If it is safe, consider traveling out of the fire area. If you must travel through burned areas, watch for burned snags and hot stump holes which could be hazardous.

3. Find A Safe Place

If you feel threatened find a large lake. Keep away from the fire's path. If the fire is upon you, don't panic. Put on your life jacket and take your canoe into the water. Paddle to the middle of the lake, tip your canoe and go under it. You can breathe the cool trapped air under your canoe until the fire passes.

Fire Management

A guiding management objective for the wilderness is to allow natural processes, including wildfire, to play their ecological role to the greatest extent possible while minimizing potential risks to human life and private property. Historically, big forest fires used to be commonplace in this area. In fact, they're part of a natural process that revitalizes the ecosystem in this fire-dependent landscape.

Please check our website at:
www.fs.usda.gov/superior
for Fire Alerts.

Winter Wilderness Travel

The BWCAW in the winter is a truly unique experience, whether traveling by dogsled, skijoring, skiing or snowshoeing. During this time of year, visitors have a very different kind of experience than those that visit during the summer season. You are less likely to run into other visitors and can experience a sense of solitude and self-reliance in a way that few other places allow. Winter wilderness travel requires a high degree of preparation, planning, skill and wisdom.

Winter temperatures in the BWCAW average 15-20 degrees Fahrenheit, with overnight lows from zero to 7 below zero. During severe cold spells, daily highs can remain below zero, with low temperatures falling into the 20 to 30 below zero range. Wind chill exacerbates the cold and blowing snow can make travel difficult. Average snowfall is 50-65 inches, with 70-90 inches along Lake Superior. Snow depths in late February to early March may be 15-25 inches with some higher terrain receiving over three feet.

Winter conditions make self-reliance, good judgment and knowledge of your limits critical. Whether you are dog sledding, skiing or snowshoeing, it is important to plan well and prevent hypothermia and frostbite:

- Be prepared for extreme cold, windy or wet conditions. Dress in layers to remain comfortable by adding or removing clothing depending on conditions and your energy level. Change into dry clothing as needed.
- Drink plenty of water and eat often. Avoid alcoholic beverages. Alcohol causes the body to lose heat more rapidly, even though one may feel warmer after drinking.
- Avoid open water and thin ice. Never walk on ice less than four inches thick.
- Hypothermia is a dangerous lowering of the body temperature. Warning signs include uncontrollable shivering, disorientation, slurred speech and drowsiness. Frostbite causes a loss of feeling and a white or pale appearance in extremities such as fingers, toes, tip of the nose and ear lobes. If symptoms of either condition are detected, get medical care immediately!

Travel Permits

Permits are required year-round for all visitors to the Boundary Waters Canoe Area Wilderness. For day or overnight travel from October 1–April 30, it's easy! Self Issued permits are available from kiosks at BWCAW entry points and Forest Service offices (no reservation required and no recreation fees).

BWCAW Regulations and Rules (see pages 6-7) apply year-round. Even though the BWCAW wears a beautiful white protective coat in the winter we still need to take care to Leave No Trace.

Courtesy of Steve Cochran

"There is something infinitely healing in the repeated refrains of nature—the assurance that dawn comes after night, and spring after winter."

– Rachel Carson

Choose a Campsite

- When lakes are open, camp at designated sites using firegrates and latrines.
- When lakes are frozen, camp on ice, in a sheltered bay or in a natural forest opening. Locate camp at least 200 feet from trails or summer campsites and out of sight of other groups.
- Make just one trail connecting the shoreline to camp.
- Bury human waste in snow 200 feet from water, campsites, summer trails and portages (pack out toilet paper and all personal waste items).

Campfires

It is preferable to make a campfire on the ice to minimize fire scars on rocks and shorelines. Use base logs or a portable fire pan for your campfire on the ice. Use a campstove or fire pan for a campfire on land to avoid leaving fire scars on vegetation or rocks.

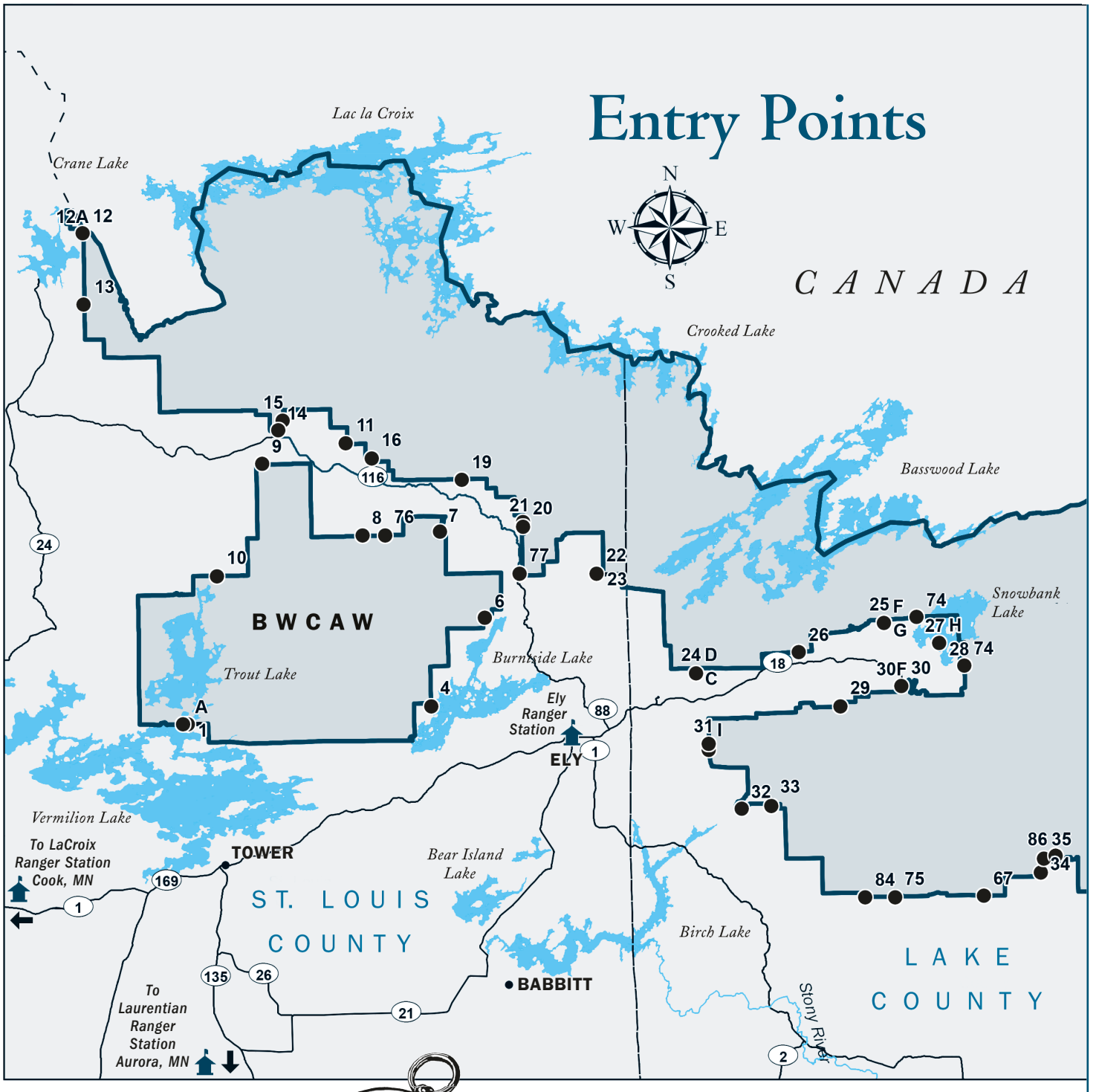
- Collect firewood far from shorelines, trails and campsites. Use only dead and downed wood easily broken by hand and smaller than your wrist. Never cut a live tree!
- Damaging any living plant is illegal. Peeling birch bark, carving, nailing or chopping roots kills the trees. Never cut live vegetation!
- Make sure your fire is out cold to the touch when you leave.
- Scatter ashes in the woods away from the shoreline and cover the campfire scar with snow.

Live Vegetation

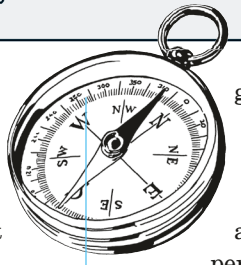
Do not cut green vegetation for tent poles, bedding for humans or dogs, or to create new dogsled trails.

Reduce Dog Impacts

- Keep dogs under control at all times.
- To avoid damaging or "girdling" trees with rope when staking out dogs, use webbing straps around trees and attach dog picket line to webbing.
- Tether teams out on the ice with ice screws to avoid damaging shoreline vegetation.
- Never bring hay or straw for bedding because they introduce non-native plants.
- Scatter dog waste in the woods at least 200 feet from the water's edge. Keep the entry points clean for others by picking up dog waste before and after hitting the trail.



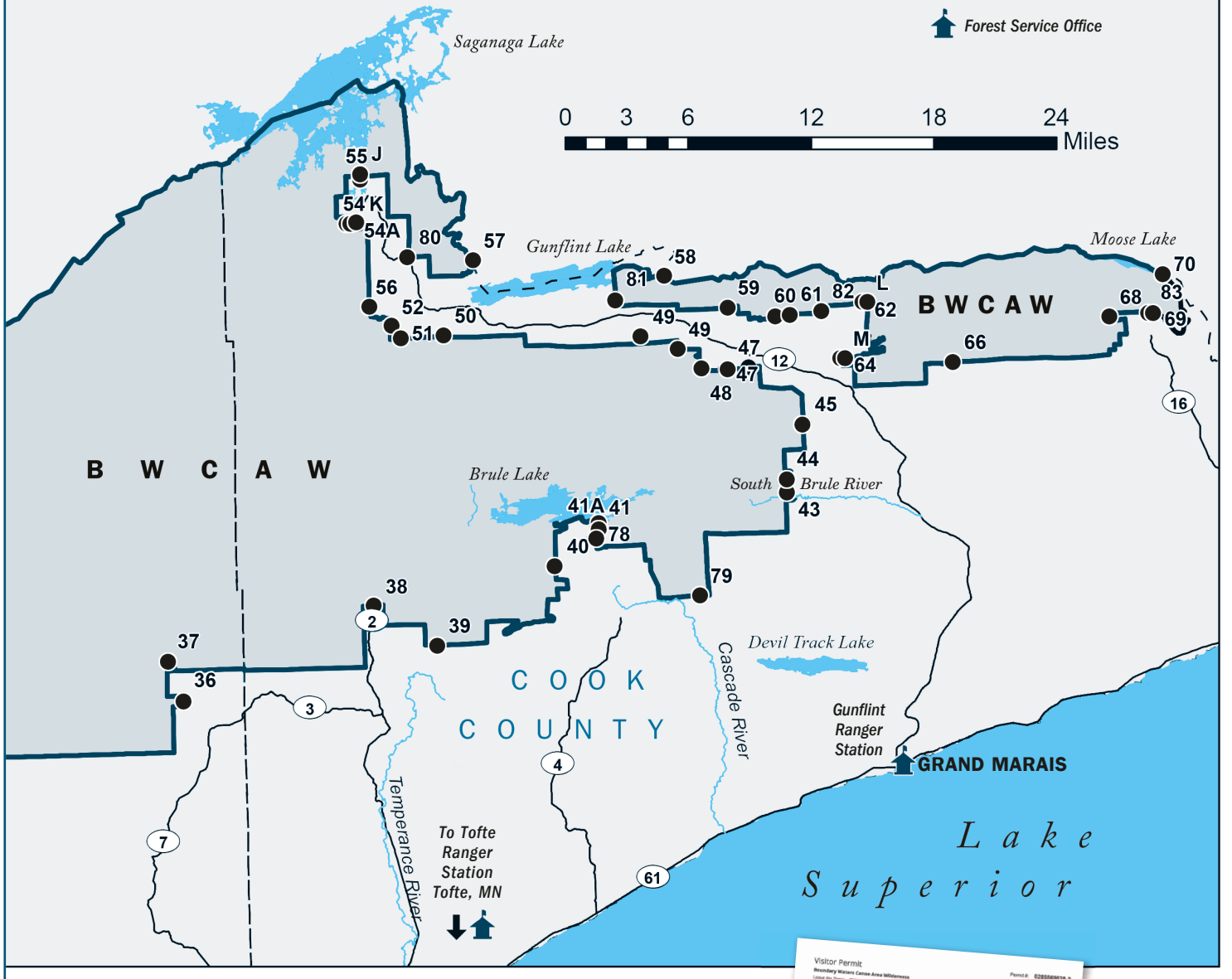
The map and charts on these pages are intended to provide a general idea of where Boundary Waters Canoe Area Wilderness entry points and Forest Service permit issuing stations are located on the Superior National Forest, as well as some basic information about each entry point. When planning your trip we highly recommend that you replace this information with maps, guidebooks and the advice of your outfitter and/or guide, if you decide to use one.



Maps and guidebooks are available from BWCAW permit issuing stations and cooperators (a ***cooperator*** is a business that has an agreement with the Forest Service to issue BWCAW permits at their location). A list of these permit issuing stations and cooperators is provided on page 24. These businesses may also assist you in locating guides and outfitters in the area you plan to visit.

A compass and accurate map are essential for backcountry travel. BWCAW maps show the location of designated campsites and portage trails, and are available from the map companies listed on the following page:

This map not for navigation.



McKenzie Maps, Inc.
800-749-2113
www.bwcamaps.com

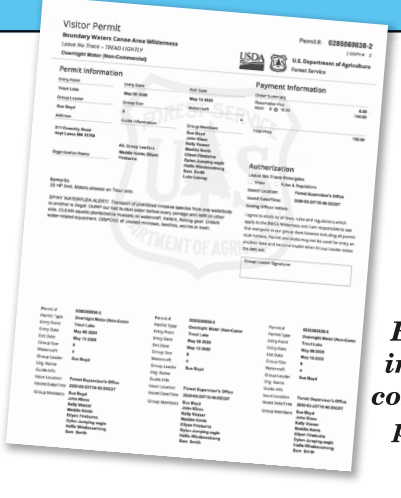
W.A. Fisher Maps
218-741-9544
www.fishermaps.com

Voyageur Maps, Inc.
www.voyageurmaps.com

Trails Illustrated Maps
800-962-1643
www.trailsillustrated.com

Travel Permits

- All group members must enter the BWCAW at the entry point and on the entry date shown on the permit.
- Permit becomes invalid when the group leader exits the wilderness.
- The person signing for and picking up the permit can only be responsible for one group.



Entry Point information continued on pages 14-15

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METHOD OF ENTRY

OVERNIGHT PADDLE ONLY

ENTRY POINT NAME	ENTRY POINT NUMBER	RESPONSIBLE RANGER DISTRICT & TOWN	OTHER REMARKS
Angleworm Lake	20	Kawishiwi/Ely	Access is a 640-rod portage to Angleworm Lake.
Baker Lake	39	Tofte/Tofte	Access is a boat landing at Baker Lake with a 10-rod portage into Peterson Lake to reach first campsite.
From Big Lake	7	Kawishiwi/Ely	Access La Pond Lake with a 160-rod portage from outside the BWCAW on Big Lake.
Bog Lake	67	Tofte/Tofte	Access is a 232-rod portage into the lake. Bog Lake has three campsites, and does not provide access to other lakes.
Bower Trout lake	43	Gunflint/Grand Marais	Access is a 72-rod portage from small parking area into Bower Trout.
Brant Lake	52	Gunflint/Grand Marais	Access is a canoe landing at Round Lake with two 85-rod portages to Brant Lake.
Brule Lake	41	Tofte/Tofte	Access is a boat landing at Brule Lake. Large lake with several campsites.
From Canada	71	Kawishiwi/Ely/ LaCroix/Cook Gunflint/Grand Marais	Use only when trip originates in Canada, then travels into the BWCAW. No camping in the Vento Unit — the area east of Gunflint Lake and north of the Gunflint and Arrowhead Trails in the BWCAW — during the month of August. See page 9, "Entry Into the U.S. From Canada" for more information.
Crab Lake & Cummings Lake		Kawishiwi/Ely	Access from Burntside Lake with a 360-rod portage to Crab Lake.
Crocodile River	66	Gunflint/Grand Marais	Can access Crocodile Lake from Crocodile River or East Bearskin. Must spend all nights on Crocodile Lake.
Cross Bay Lake	50	Gunflint/Grand Marais	Access is thru the Cross River with two portages to Ham Lake and a 24-rod portage to Cross Bay Lake.
Daniels Lake	61	Gunflint/Grand Marais	Access is from W. Bearskin Lake with a 60-rod portage to Daniels Lake and 665-rod portage to Rose Lake.
Duncan Lake	60	Gunflint/Grand Marais	Access is from W. Bearskin Lake with a 70-rod portage to Duncan Lake and an 80-rod portage to Rose Lake.
Hog Creek	36	Tofte/Tofte	Access is a 15-rod portage to Hog Creek leading into Perent Lake.
Homer Lake	40	Tofte/Tofte	Access is a boat landing at Homer Lake. Part of Homer Lake is outside of the BWCAW (motors allowed)
Island River	34	Tofte/Tofte	Two small portages leading to Isabella River.
Isabella Lake	35	Tofte/Tofte	Access is a 70-rod portage to Isabella Lake.
John Lake	69	Gunflint/Grand Marais	Access from Little John Lake with a 10-rod portage to John Lake.
Kawishiwi Lake	37	Tofte/Tofte	Access is a boat landing at Kawishiwi Lake.
Lake One	30	Kawishiwi/Ely	Access is a canoe landing at Lake One.
Larch Creek	80	Gunflint/Grand Marais	Access from the canoe landing at Larch Creek.
Little Gabbro Lake	33	Kawishiwi/Ely	Access is a 200-rod portage from the parking lot to Little Gabbro Lake.
Little Indian Sioux River South	9	LaCroix/Cook	Heading South from the Echo Trail. Difficult route. Four portages to Bootleg Lake.
Little Indian Sioux River North	14	LaCroix/Cook	Access is a 40-rod portage heading North from the Echo Trail.
Little Isabella River	75	Tofte/Tofte	Access is a 20-rod portage to Little Isabella River. Several short portages lead to the Isabella River.
Lizz & Swamp Lakes	47	Gunflint/Grand Marais	Access from Poplar Lake by 51-rod portage to Lizz Lake and 100-rod portage into Swamp Lake.
Magnetic Lake	57	Gunflint/Grand Marais	Access Magnetic Lake and Granite River from Gunflint Lake.
Meeds Lake	48	Gunflint/Grand Marais	Access from Poplar Lake into Meeds Lake with a 220-rod portage.
Missing Link Lake	51	Gunflint/Grand Marais	Access is a canoe landing at Round Lake with a 142-rod portage to Missing Link Lake.
Moose River South	8	LaCroix/Cook	Access is a canoe landing heading South from the Echo Trail. Three portages to enter Big Moose Lake.
Moose/Portage River North	16	LaCroix/Cook	(North of Echo Trail) Access is a 160-rod portage heading North from the Echo Trail.
Morgan Lake	45	Gunflint/Grand Marais	Access is a 320-rod portage to Morgan Lake. No campsites on Morgan Lake–short portages to further lakes for campsites.
Mudro Lake	23	Kawishiwi/Ely	Access into Mudro Lake involves portages ranging from 20–185 rods.
Mudro Lake–Restricted	22	Kawishiwi/Ely	Three accesses into Mudro Lake involve portages ranging from 20–185 rods. Restriction is no camping on Horse Lake.
North Fowl Lake	70	Gunflint/Grand Marais	Access from Little John Lake with an 88-rod and a 160-rod portage to get to North Fowl Lake. Border lake between U.S. & Canada.
North Kawishiwi River	29	Kawishiwi/Ely	Access the North Kawishiwi River through Ojibway Lake and Triangle Lake using two portages.
Pine Lake	68	Gunflint/Grand Marais	Access through McFarland Lake by a 2-rod portage.
Ram Lake	44	Gunflint/Grand Marais	Access is a 97-rod portage from the parking area.
Sawbill Lake	38	Tofte/Tofte	Access is a boat landing at Sawbill Lake.
Skipper & Portage Lakes	49	Gunflint/Grand Marais	Access is a 320-rod portage from Poplar Lake or a 230-rod portage from Iron Lake.
Slim Lake	6	Kawishiwi/Ely	Access is a 90-rod portage to Slim Lake Portages to three additional lakes.
Snake River	84	Tofte/Tofte	Access is a 198-rod portage to Snake River & several short portages before reaching Bald Eagle Lake.
Snowbank Lake Only	28	Kawishiwi/Ely	Must camp all nights on Snowbank Lake. Paddle day trips to other lakes are permitted. Access is a boat landing or canoe launch at Snowbank Lake.
South Hegman Lake	77	Kawishiwi/Ely	Access is a 80-rod portage to South Hegman Lake.
South Kawishiwi River	32	Kawishiwi/Ely	Access is a 140-rod portage to the river.
South Lake	58	Gunflint/Grand Marais	Access is from Gunflint Lake with a 10-mile paddle and two short portages to South Lake.
Stuart River	19	Kawishiwi/Ely	Access is a 480-rod portage to the Stuart River.
Wood Lake	26	Kawishiwi/Ely	Access to Wood Lake is a 180-rod portage.

Traveling to or from Canada by paddle? Select "Paddle to/from Canada" for the permit type when reserving your permit.

To check availability for entry points, please visit www.recreation.gov

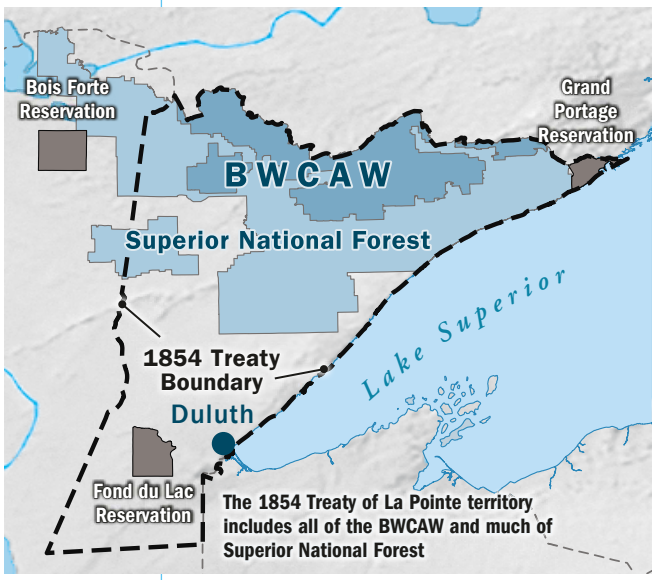
METHOD OF ENTRY	ENTRY POINT NAME	ENTRY POINT NUMBER	MOTOR HORSEPOWER LIMIT	RESPONSIBLE RANGER DISTRICT & TOWN	OTHER REMARKS
OVERNIGHT PADDLE or MOTOR	Clearwater Lake	62	10 HP	Gunflint/Grand Marais	Motors allowed on Clearwater Lake only.
	East Bearskin Lake	64	25 HP	Gunflint/Grand Marais	Motors allowed on East Bearskin Lake only. No motors on Alder & Canoe.
	Fall Lake	24	25 HP	Kawishiwi/Ely	Access is a boat landing at Fall Lake. Several trip options to Newton, Basswood, & Mud Lakes with additional portages.
	Farm Lake	31	25 HP	Kawishiwi/Ely	Access is a boat landing on Farm Lake with access to South Farm Lake. Paddlers access North Kawishiwi River from Farm Lake. Some trip options available for paddlers with additional portages.
	Lac La Croix Only	12A	Unlimited (except where paddle only)	LaCroix/Cook	Enter from Crane Lake. You must camp all nights on Lac La Croix. Day trips to other lakes permitted. Use this entry point only after Entry Point 12 Little Vermilion Lake is full. Very difficult to reach Lac La Croix by paddle in one day.
	Little Vermilion Lake	12	Unlimited	LaCroix/Cook	Enter from Crane Lake. Note: not the entry point to use for Trout Lake (#1). On U.S. side motors allowed only up to edge of Snow Bay on Lac La Croix.
	Moose Lake	25	25 HP	Kawishiwi/Ely	Access is an boat landing or canoe launch at Moose Lake. Many trip options for paddlers with additional portages.
	Saganaga Lake	55	25 HP (except where paddle only)	Gunflint/Grand Marais	No motors (use or possession) west of American Point. Access to Canada (the Crown land and Quetico Park). Large lake with many campsites and easy access.
	Seagull Lake	54	10 HP (except where paddle only)	Gunflint/Grand Marais	No motors (use or possession) west of Three Mile Island. Large lake with several campsites. Landing at Seagull Lake.
	Snowbank Lake	27	25 HP	Kawishiwi/Ely	Access is a boat landing or canoe launch at Snowbank Lake. Many trip options for paddlers.
	Trout Lake	1	25 HP	LaCroix/Cook	Access from Vermilion Lake via a 60-rod canoe portage or 180-rod portage that allows the use of portage wheels.
	Overnight Paddle and Overnight Motor permits share the preceding entry points, so motors may be encountered along portions of the route.				
DAY USE MOTOR	Clearwater Lake	L	10 HP	Gunflint/Grand Marais	Motors allowed on Clearwater Lake only.
	East Bearskin Lake	M	25 HP	Gunflint/Grand Marais	Motors allowed on East Bearskin Lake only. No motors on Alder or Canoe Lakes.
	Fall Lake Only	C	25 HP	Kawishiwi/Ely	Valid only on Fall Lake not Newton or Basswood. Access is a boat landing at Fall Lake.
	Fall Lake, Newton, Pipestone & Beyond	D	25 HP	Kawishiwi/Ely	Access is a boat landing at Fall Lake. Valid on Fall, Newton & Basswood.
	Moose Lake to Newfound & Sucker Lakes	F	25 HP	Kawishiwi/Ely beyond Sucker Lake	Valid only on Moose, Newfound and Sucker Lakes. Travel not permitted
	Moose Lake to Prairie Portage to Basswood	G	25 HP (except paddle only areas)	Kawishiwi/Ely	Commercial portage service available. Valid on Moose, Newfound, Sucker and Basswood Lakes.
	Saganaga Lake	J	25 HP	Gunflint/Grand Marais	No motors (use or possession) west of American Point. Access to Canada.
	Seagull Lake	K	10 HP	Gunflint/Grand Marais	No motors (use or possession) allowed west of Three Mile Island.
	Snowbank Lake	H	25 HP	Kawishiwi/Ely	Motors allowed on Snowbank Lake only.
	South Farm Lake	I	25 HP	Kawishiwi/Ely	Motors allowed on South Farm Lake only.
	Trout Lake	A	25 HP	LaCroix/Cook	Access from Lake Vermilion via a 180-rod portage suitable for portage wheels. Commercial portage service available.
	Traveling to or from Canada by motor? Select "Motor to/from Canada" for the permit type when reserving your permit.				
OVERNIGHT HIKING	Angleworm Trail	21		Kawishiwi/Ely	Trail loops around Angleworm Lake. 12 miles. If paddling, use entry point #20.
	Big Moose Lake Trail	76		LaCroix/Cook	No loop options. 2 miles to Big Moose Lake. If paddling use Entry Point #8.
	Blandin Trail	11		LaCroix/Cook	Winter route to Lamb Lake. 2.4 miles.
	Border Route Trail—East	83		Gunflint/Grand Marais	53 miles. Shorter options available.
	Border Route Trail—Center	82		Gunflint/Grand Marais	53 miles. Shorter options available.
	Border Route Trail—West	81		Gunflint/Grand Marais	53 miles. Shorter options available.
	Brule Lake Trail	78		Gunflint/Grand Marais	Trailhead is on Forest Road 326, 1/3 mile south of the Brule Lake parking lot on the east side of the road. Parking at Brule Lake lot. Total trail distance is 7 miles.
	Eagle Mountain Trail	79		Gunflint/Grand Marais	The trail is 3.5 miles to the top (one way). Provides access to Brule Lake Trail.
	Herriman Lake Trail	13		LaCroix/Cook	15 miles of trail accesses 4 lakes. Loop options.
	Norway Trail	10		LaCroix/Cook	8 mile trail or 2 mile option. No loops.
	Kekekabic Trail—East	56		Gunflint/Grand Marais	46 mile trail that continues to the west side trail head. Rolling terrain through several lakes. Minimal use.
	Kekekabic Trail W./Snowbank	74		Kawishiwi/Ely	Loop option includes 27 miles of the Snowbank trail, plus the 46 mile Kekekabic Trail that continues to the east side trail head.
	Partridge Lake/S. Lake Trail	59		Gunflint/Grand Marais	4 miles. If paddling use Entry Point #60.
	Pow Wow Trail	86		Tofte/Tofte	30 mile loop trail.
	Sioux-Hustler Trail	15		LaCroix/Cook	30 mile round trip with loop. Primitive trail not well maintained.

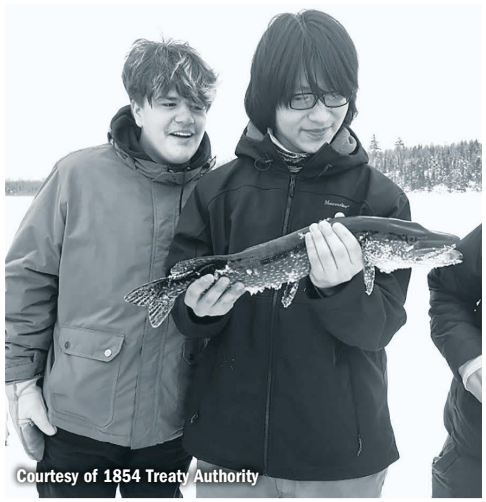
BWCAW Past, Present and Future

Treaty Obligations

Indigenous peoples have utilized the Boundary Waters Canoe Area Wilderness (BWCAW) for a millennia. These are the traditional territories of the Ojibwe, or Anishinaabeg. Original transportation routes used by Indigenous peoples were traversed by voyageurs during the fur trade. The rugged terrain in this water-rich landscape continuously impeded widespread non-Indigenous settlement and development throughout time. Nearly all the portages and canoe routes that exist today are the original passageways!

During settlement, Native inhabitants retained subsistence rights throughout what is now Northeastern Minnesota, in the 1854 Treaty of La Pointe: "And such of them as reside in the territory hereby ceded, shall have the right to hunt and fish therein, until otherwise ordered by the President" (Article 11, Treaty with the Chippewa, 1854). Presently, the inter-Tribal natural resource management agency, 1854 Treaty Authority, implements and protects off-reservation hunting, fishing, and gathering for the Bois Forte Band of Chippewa and the Grand Portage Band of Lake Superior Chippewa. Similarly, the Great Lakes Indian Fish & Wildlife Commission (GLIFWC) works directly with the Fond du Lac Band of Lake Superior Chippewa to affirm and apply their treaty rights within the 1854 ceded territory. All three Bands continue to exercise these rights within the five and a half million acres of 1854 ceded territory, which encompasses most of the Superior National Forest, including the BWCAW. Treaty rights are still upheld, and Band members continue to exercise those rights and carry-on traditional ways.




Courtesy of 1854 Treaty Authority

akwa'waa, "s/he fishes through the ice with spear"

The BWCAW was federally designated in 1978. This proclamation had the purpose of preserving the integrity of the area as one 'absent of residential people.' However, Ojibwe families remained in the BWCAW well into the twentieth century prior to being removed to reservations (and reserves in Canada). For example, an Anishinaabeg community thrived on Basswood Lake until the Indian Agent compelled them to be removed. Authorities were anxious to stop traditional lifeways, particularly families' seasonal moves to areas with abundant natural resources such as a variety of fish species, but especially where whitefish, blueberries and caribou could be harvested.


Courtesy of 1854 Treaty Authority

Visitors using the woods and water for recreation and treaty harvesters alike share an interest in protecting and maintaining the quality of these resources. Local relationships have shaped canoe country since time immemorial. The Anishinaabeg view those who share the landscape with us as 'relatives,' not only the two-legged, but the four-legged and even plants. Visitors, please note the importance in acknowledging this Indigenous homeland and the reserved rights not yet realized by a future generation of children.

Recent Events that have shaped the BWCAW

What is Wilderness?

On September 3, 1964 The Wilderness Act was signed into law. The Boundary Waters Canoe Area Wilderness was also designated with the passing of this Act. The Wilderness Act provided a legal definition of wilderness, created the National Wilderness Preservation System, established a process to be used for designating wilderness areas, and set provisions for the use of wilderness areas. The intent of the Wilderness Act was to establish wilderness areas "for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness." Legal wilderness, "in contrast with those areas where man and his own works dominate the landscape," is "recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."

Four federal agencies manage designated Wilderness in the United States: National Park Service, the U.S. Forest Service, Bureau of Land Management, and U.S. Fish and Wildlife Service.

Photo taken by Arthur Carhart, 1921.

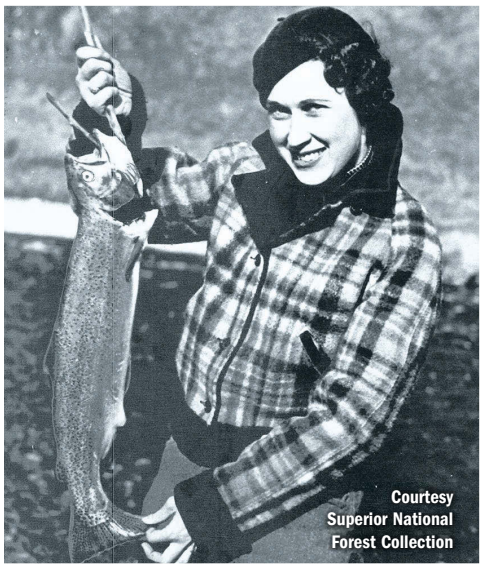
"A civilization which destroys what little remains of the wild, the spare, the original, is cutting itself off from its origins and betraying the principle of civilization itself."

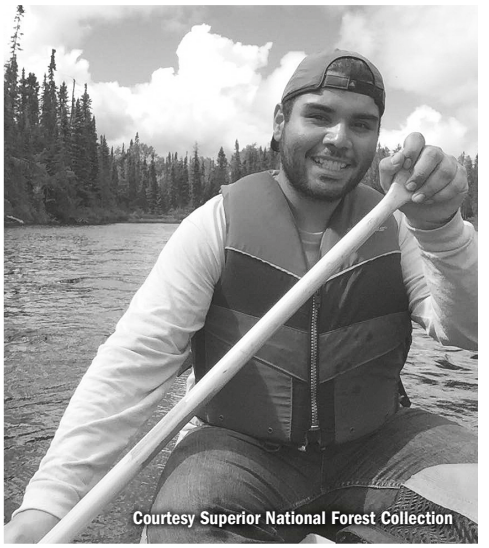
— Edward Abbey

Why Wilderness?

When we talk about wilderness it is important to differentiate when we are talking about wilderness based on our personal definition, wilderness as defined by non-federal land managers, and federally designated wilderness. There are now 765 federally designated wilderness areas nationwide with a total of 109,129,657 acres. These areas provide multiple benefits including:

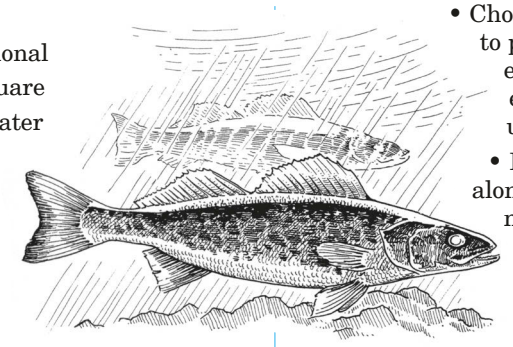
- Protects watersheds and plays an important role in oxygen production, CO_2 absorption, soil building, biomass decomposition, insect regulation, and filtering air pollution.
- Is a natural lab in which we can study natural processes. Society can benefit from this scientific research as it enlarges our understanding of the world and our roles in it.
- Holds educational and training value for schools and universities. It is an important classroom for learning primitive outdoor skills such as orienteering, survival, mountaineering, stock packing and paddling.
- Has aesthetic value appreciated through intimate contact with the environment where people can experience sights, sounds and feelings they are unable to experience in developed and less natural settings.
- Holds, for some, philosophical and religious value. To them wilderness is a place with natural cathedrals where people can celebrate the creative forces behind life.
- Has an intrinsic value hypothesizing that plants, animals, inanimate objects and the ecosystems that they inhabit, have rights of their own to exist.
- Provides a window into the past to study, understand and learn from historic and prehistoric uses and cultures of the area.





Protecting Your Natural Resources

Fisheries



The Superior National Forest has 695 square miles of surface water and more than 2,250 linear miles of streams that offer a wide range of fishing opportunities in all seasons. Coldwater game species include lake trout, walleye, brook trout, pike and smallmouth bass. Some lakes and streams within the Superior National Forest have special regulations, so always check the Minnesota DNR fishing regulations when you plan your trip.

The Forest works in collaboration with several agencies to accomplish management objectives and discusses employing the minimum tool necessary to administer the area as wilderness. This effort maintains healthy aquatic resources on the Superior National Forest.

Stocking

Limited stocking occurs in BWCAW lakes and they are stocked primarily with brook trout, lake trout and walleye. Lake trout and brook trout populations can be very susceptible to overfishing. They may require regular stocking to maintain a fishable population.

What You Can Do

Care for the fish, their aquatic habitat and their terrestrial neighbors. Regulations are meant to ensure sustainable fish populations and healthy lakes and rivers.

- Practice catch and release, even when you are within the allowable catch.
- Handle fish gently, quickly and in the water.
- To prevent the spread of aquatic invasive species, obey AIS laws (see page 20) and use artificial bait.
- Keep fish horizontal for pictures.
- If you plan to keep a fish, kill it right away and be prepared to keep the gutted fish on ice.
- Choose lead-free tackle to prevent adverse effects on aquatic ecosystems and ultimately humans.
- Leaving fish remains along shore can alter natural behaviors, expose animals to predators, cause stress, and even cause unnatural fluctuations in numbers, as with increased gulls in some areas. Scatter remains back in the woods at least 200 feet away from the shore or camping areas.

Large Groups

If you are planning a trip for a non-profit organization, there is a limit of no more than 3 permits in a season to be reserved using the non-profit organization name as the group leader. Please contact any Superior National Forest office for more information, or visit www.recreation.gov under general rules for the BWCAW.

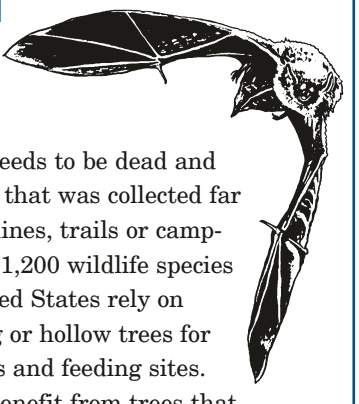
Keep these tips in mind when planning for large groups to reduce environmental and social impacts:

- If your group is more than nine people, regardless of the age, you may not enter the BWCAW. Consider other options, such as camping at a primitive or developed campground and boating on lakes outside the designated wilderness area (see page 2).
- If your group of more than the maximum size wishes to break into smaller groups to enter the BWCAW, each smaller group must have its own permit.
- Each group must travel and camp separately. This means each should have its own food, first aid kit and essential gear. To make it easier for the groups to travel separately, reserve different entry points and plan separate routes.
- Each group should have an adult who will be responsible for the leadership and safety of the group.
- And if you do know other visitors in the area, don't purposely congregate in a group larger than 9 while traveling, visiting a destination area or camping.
- Portages and waterways can become very congested. Wait for another group to cross the portage before you begin, portage your gear efficiently and find another place for your break. Keep your distance from other groups on the waterways.
- Begin looking for campsites early in the day and share tents since many wilderness sites only have one or two good tent pads.
- Encourage your group members to use campsite areas that have already been hardened rather than trampling vegetation and causing erosion.

Noise

Being considerate of other wilderness visitors is one of the 7 Leave No Trace Principles. A courteous group can do wonders to minimize the impact of noise. Sound carries a long distance over water, mostly in the evening when people are listening more than moving. Try to avoid banging pots and pans, dragging canoes over rocks, shooting guns, singing loudly and screaming, especially in the morning and evening. If your group is rambunctious, consider staying in a more isolated area such as a lake with only one campsite. When you keep noise down, your group and others will have a better chance of experiencing wildlife and a sense of solitude.

Bats and Other Wildlife Habitat



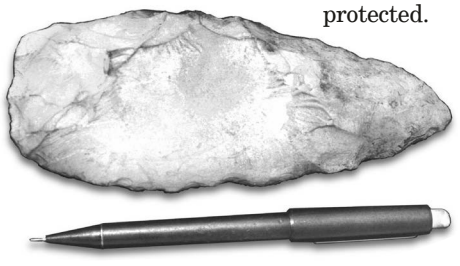
Firewood needs to be dead and down wood that was collected far from shorelines, trails or campsites. Over 1,200 wildlife species in the United States rely on dead, dying or hollow trees for dens, roosts and feeding sites. Even fish benefit from trees that have fallen into streams and lakes. Trees that demonstrate disease or have defects or other features are most often those that provide excellent habitat for a variety of wildlife species.

One species of high importance is the northern long-eared bat (*Myotis*

septentrionalis). This bat species was recently listed as Federally Threatened by the U.S. Fish and Wildlife Service. This designation is a result of the devastation that this bat has experienced from a fungal disease called White nose Syndrome (WNS). WNS affects hibernating bats by causing them to wake up more frequently. This increase in activity depletes the bats' energy stores needed to survive winter, causing them to eventually die from starvation, dehydration and exposure. Researchers estimate that over 5.5 million bats have died as a result of being infected with wns. To find out more about WNS, please visit ***www.whitenosesyndrome.org***

Heritage Resources

Leave No Trace wilderness principles apply not only to the natural environment but also to archaeological resources. Over 1,200 archaeological sites have been identified within the Boundary Waters Canoe Area Wilderness. These sites include Native American rock art, stone tools and pottery sherds, glass beads and fur-trade artifacts, and mining and logging camps. These sites provide us with a fascinating window into the history of human use of the Boundary Waters over the past 10,000 years. However archaeological materials are a non-renewable resource and must be protected.



View of a prehistoric siltstone biface *identified within the BWCAW. Bifaces are considered 'preforms' that have been flint knapped on both sides, are easily transported, and can be eventually worked down into spear points*

Once an artifact is removed from its context within a site we lose much of the valuable information it can provide us about who was using the site, when, and for what.

Respect cultural resources as you would natural resources. If you come across an archaeological site do not remove or disturb artifacts. Excavating, defacing or removing an archaeological resource from federal lands without a permit is a crime punishable by fines or imprisonment. Write down a description of what you found, including the location, and report it to Forest Service personnel. Photos, sketches, maps or GPS information are all useful information to include when describing archaeological finds.

Non-Native & Invasive Species

Non-native invasive species (NNIS) are plants, animals, insects or other organisms whose introduction to an area cause or are likely to cause economic or environmental harm or harm to human health. Other names for NNIS include exotic species, noxious weeds, pests, etc. Invasive species can occur on land or in the water. Some examples in Minnesota include purple loosestrife, gypsy moth, emerald ash borer, Eurasian water milfoil, earthworms, spiny water flea, rusty crayfish and orange hawkweed. If you see these species on the Forest report their known locations if possible.

Because invasive species do not respect property lines, we are working with other agencies, non-governmental organizations, and citizens like you to increase awareness of this resource management issue and take action to stop the spread of NNIS in our area. For more information about invasive species in Minnesota, go to the MN Department of Natural Resources website at: ***www.dnr.state.mn.us/invasives/index.html***

Prevention:

- Clean your gear/boat before entering and leaving the wilderness or recreation site.
- Remove mud and seeds from clothes, pets, boots, gear and vehicles.
- Burn only local or certified firewood.
- Do not pick wildflowers and transport them from one location to another.

The Gypsy Moth Threat

The non-native gypsy moth is a threat to the forests of the BWCAW and the rest of northeast Minnesota. Gypsy moth caterpillars consume the foliage of several types of trees and can destroy millions of acres of forest each year.

During late summer, the female moth lays fuzzy, tan-colored egg masses about the size of a quarter. Each mass contains 500-1,000 eggs which hatch the following the spring when the weather is right.

Egg masses can be found on living and inanimate objects,

including trees, logs, firewood, campers, canoes, vehicles and lawn chairs. People may unintentionally help spread the gypsy moth by moving these objects with egg masses attached. This is how the moth got its name.

The Superior National Forest has worked with other agencies for several years to slow the spread of the gypsy moth in our area through various treatments. Quarantines are currently in effect in Cook and Lake counties.

What you can do:

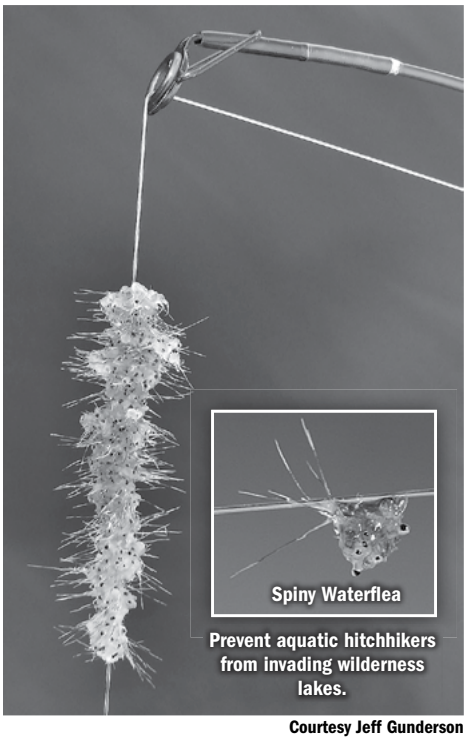
- Carefully inspect your vehicles, equipment, firewood, etc. for egg masses.
- Do not transport egg masses. Remove and destroy them.
- Follow any restrictions, including quarantines and inspections.
- Visit the Superior National Forest and MN Department of Agriculture web sites at: ***www.mda.state.mn.us/plants/pestmanagement/spongymothunit***

Continued i

Stop Aquatic Invaders

The introduction of Aquatic Invasive Species (AIS) such as spiny water flea and rusty crayfish to new water bodies can harm native organisms as well as negatively impact recreation, fishing and overall enjoyment of our lakes and rivers. Most BWCAW waters are not infested with AIS, and they are ours to protect.

AIS can spread to lakes and rivers by "hitching" rides on watercraft, fishing gear and any other equipment in contact with the water including via non-motorized travel (canoes and kayaks) between remote waterbodies.



Courtesy Jeff Gunderson

Q. How do I prepare my boat or canoe for launch?

A. Inspect your watercraft, motor, trailer and equipment for aquatic plants, animals, mud and water. Remove any that you find and clean and dry those areas.

Q. What should I do when leaving a waterbody or at a portage?

A. Clean, Drain and Dry your watercraft and equipment as best you can. Minnesota law requires that you clean off plants, animals and mud, and drain all water from bait containers and watercraft. You must remove any drain plugs, open any water draining valves and drain any portable bait containers before leaving the water access. Leave drain plugs out while transporting watercraft. Inspect fishing line and down rigger cables for attached AIS and remove anything you find.

Q. How do I comply with draining portable bait containers when portaging?

A. Drain water from the bait container on land where it won't drain into any water body and refill it on the other side.

Q. What do I do with left over bait?

A. Minnesota state law prohibits dumping unused bait into water, pack it out with your trash. Dumping bait on the ground is littering. Keep unused bait for future use by replacing the water in portable bait containers with bottled or tap water.

Q. How do I find out about invasive species?

A. For a list of prohibited invasive species and Minnesota invasive species laws, visit: ***www.dnr.state.mn.us/invasives/laws.html*** or contact the MN DNR at 888-646-6367.

To report a new instance of an invasive species, go to ***EDDMapS.org*** or use the Wild Spotter app, which is based on EDDMapS but designed for offline use in remote areas. Or report to a DNR AIS Specialist.

The following are Prohibited:

- Moving fish from lake to lake by releasing fish off of stringers (many common species, such as walleye and smallmouth bass are themselves not native to large areas of the BWCAW).
- Using live minnows on designated stream trout lakes, including those in the BWCAW.
- Disposing of earthworms in the Forest. A person must not dispose of bait in waters of the state. (84 D.10, subd. 4.). Pack out all unused bait.

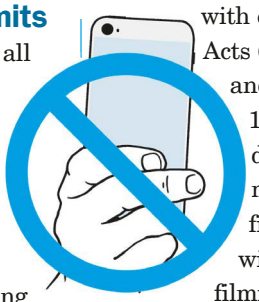
Unlike much of the U.S., the Arrowhead Region and the Superior National Forest are fortunate because many of the species that are a problem in the upper Midwest are not well established here yet. However, terrestrial and aquatic NNIS* can quickly spread once introduced into the environment. NNIS can spread via air, water and on watercraft, equipment, firewood and even the mud on your boots. Some NNIS seem harmless, like earthworms, but can alter an entire forest floor changing the vegetation.

**non-native invasive species*

Special Uses

Filming & Photography Permits

A special use permit is required for all commercial filming activities and commercial activities which capture still images on film or in a digital format on National Forest Lands. Commercial filming is defined as the use of motion picture, video-taping, sound recording, other moving image or audio recording equipment (including cell phones) that involves the advertisement of a product or service, the creation of a product for sale or the use of actors, models, sets or props.



No commercial filming with your cellphone!

Commercial Filming in Designated Wilderness

Proposed commercial activities in designated wilderness areas, such as the BWCAW, are reviewed for compliance with existing regulations and Acts (Wilderness Act of 1964 and The BWCAW Act of 1978). Filming outside designated wilderness must always be considered first. The Forest Service will authorize commercial filming or photography activities within designated wilderness areas only when certain conditions are met, and there is still no guarantee of a permit.

Personal Use

If you are shooting still photographs or 'home movies' for personal use that do not involve advertisement of a product or service, or the creation of a product for sale, then a special use permit is not required.

Outfitter/Guide Permits

All individuals, organizations and non-profits conducting outfitting or guiding activities on National Forest Lands or adjacent waters must inquire if such activity is classified as "commercial." Commercial guides, church or youth groups, ski instructors, bus tours and canoe groups are all examples of commercial activities that require an Outfitter/Guide Permit.

Information?

For more information on special use permits and application forms, please visit: www.fs.usda.gov/main/superior/passes-permits/event-commercial

Research and Monitoring

During the summer, you may notice people working on various lakes in the BWCAW. They may be other land management agencies, universities or research stations. The information gathered is used to develop long term resource management strategies. Use of motorized equipment or transportation in the non-motorized areas of the BWCAW will be limited to what is absolutely necessary to manage the area as wilderness.

Air Quality

Measuring Air Pollution

Monitoring air and precipitation helps us measure air pollution. Along with monitoring the health of the Forest, we can determine when air quality is a problem and identify actions to reduce its harmful effects.

Poor Visibility Or Regional Haze

Unfortunately, the beauty of our wilderness can be diminished by haze. Haze can reduce the distance you see and even change the apparent colors and textures of the landscape. Recognizing the importance of visual air quality, Congress passed legislation to fix this problem through research and emission reductions from pollution sources. Natural haze caused by fog can decrease visibility, but the addition of air pollution makes visibility worse. Our air monitoring shows that air emissions from human activities reduce visibility on an average day to about 60%.

Acidity Of Rain And Snow

The Superior National Forest is home to one of over 200 sites spanning the continental U.S., Alaska, Puerto Rico and Virgin Islands sampling rain and snow weekly to check its chemistry. Precipitation that falls here has higher than natural levels of acidity, but is not thought to be dangerous to the Forest at this time. In addition to being the main cause of poor visibility, sulfates and nitrates are also the two main sources of acid rain. Sulfate pollution is primarily due to coal combustion while nitrate pollution is from all fuel burning activities, especially automobiles. Sulfate pollution is decreasing due to state and federal air pollution control regulations while nitrate pollution is increasing.

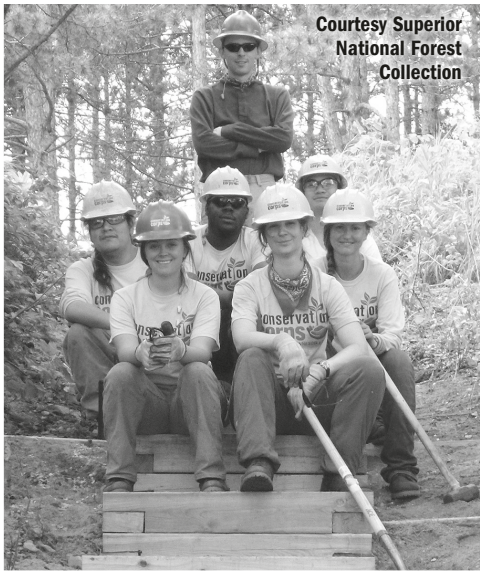
What You Can Do

- **Pack Out Your Trash:** State law does not permit open burning of oils, rubber, papers/packaging, plastics, chemically treated materials or other materials that produce noxious smoke. Burning waste — in a campsite or in your back yard — can cause severe health problems and pollute air, soils and water due to carcinogens like dioxin.
- **Conserve Electricity and Fuels:** Most air pollutants come from transportation and the generation of electricity. Saving gas and reducing electrical use, will improve air quality and the health of your National Forest.
- **Learn About Air Pollution:** Even if you live hundreds of miles away, your actions can affect the air quality here on the Superior National Forest. Air masses travel long distances over a number of days, picking up air pollution from industrial and populated areas, and carrying it to the Forest. Learn more at ***www.fs.usda.gov/air/wilderness_monitoring.htm***

Volunteering

We Need You to Help Carry the Load

An increasing number of people recreate on Forest Service managed lands every year, yet congressionally appropriated funding does not keep pace with resource management needs. To retain the enduring value and 'wilderness character' of the BWCAW, we need volunteers to help carry the load. The Forest Service partners with several organizations to address the backlog of deferred maintenance work and underfunded projects within or near the Superior National Forest in NE Minnesota. These organizations offer a variety of volunteer opportunities including single day trail stewardship events, multi-day wilderness projects, visitor use monitoring in the BWCAW and service projects tailored to fit the needs of your organization or group. By getting involved with stewardship activities, either through participating in a volunteer project or making a donation, you can help ensure that public lands are preserved for the enjoyment of future generations. For more information, please contact: (218) 626-4314.


Courtesy Superior National Forest Collection

Your User Fees at Work

Meeting the increasing needs of visitors; delivering quality recreation, heritage and wilderness opportunities; and protecting our natural and cultural resources can be challenging. Your overnight permit fees go directly back to the BWCAW to maintain and improve natural resources, recreation facilities and services including:

- When visitors pick up their wilderness permits, a short video is shown to review BWCAW Regulations and Rules. The BWCAW visitor education videos are part of the wilderness experience.
- Visitor contact by Wilderness Rangers in the BWCAW is also an important part of wilderness education and law enforcement.
- Campsite improvements such as transplanting native vegetation to encourage campsite recovery, improving tent pads, naturalizing illegal sites, cleaning and repairing fire grates, latrine replacement, hazard tree removal, non-native species removal and erosion repair and prevention.
- Winter dog sled program as a means of transporting equipment and/or supplies needed to complete maintenance work on campsites, portages and trails as well as for public user education and law enforcement contacts. This helps prevent the need for using motorized transport.
- Portage and hiking trail improvements such as clearing brush and fallen trees, installing water barriers to prevent erosion, and repairing trail tread and structures.


Before


After

The Heart of the Continent International Partnership

Spanning the international border between northeastern Minnesota and northwestern Ontario lies an international treasure: the largest expanse of public green space in the heart of North America. This 5.5 million acre landscape comprises working forest, rugged scenery, clean watersheds, abundant wildlife and outstanding biodiversity. Encompassed by this ecosystem at the "heart of the continent," are several separately managed natural areas including Quetico Provincial Park, Superior National Forest, Voyageurs National Park, Grand Portage National Monument, La Verendrye Provincial Park, additional Ontario provincial parks as well as Minnesota state forest lands and parks.

The Heart of the Continent Partnership (HOCP) is the Canadian/American coalition working together on cross-border projects that promote the economic, cultural and natural health of the lakes, forests and communities on the Ontario/Minnesota border. To learn more about the partnership's conservation goals, please visit: ***www.heartofthecontinent.org/***

Sample Trip Itinerary

Always leave a Trip Itinerary with someone before departing.

Remember, wilderness travel requires self-reliance and good judgement.
Never take unnecessary risks that jeopardize the safety of your group!

Permit # _____

Trip Leader's Name _____

Entry Point _____ Exit Point _____

Entry Date _____ Exit Date _____

Number of People _____ Number of Watercraft _____

Name of Outfitter _____ (if applicable)

Vehicle(s) Driven (Color, Make, Model) _____

License Number(s) _____

Potential Route (lakes/rivers you plan to travel) _____

_____

_____

Select nearest Forest Service Ranger Station:

- ❑ Kawishiwi Ranger Station, Ely (218) 365-7600
- ❑ Gunflint Ranger Station, Grand Marais (218) 387-1750
- ❑ Tofte Ranger Station, Tofte (218) 663-8060
- ❑ LaCroix Ranger Station, Cook (218) 666-0020
- ❑ Laurentian Ranger Station, Aurora (218) 453-8650

Select the county where you will enter / exit the BWCAW:

(see entry point map on pages 12 and 13)

❑ St Louis County ❑ Cook County ❑ Lake County

In Case of Emergency

In case of emergency or if search and rescue assistance is needed, call **9-1-1** or the nearest county sheriff's office.

St. Louis County Sheriff	***Cook County Sheriff***	***Lake County Sheriff***
Ely/Cook Area	Grand Marais/Tofte Area	Isabella Area
(218) 726-2340	(218) 387-3030	(218) 834-8385

YOU ARE RESPONSIBLE FOR ACCURATELY ESTIMATING YOUR RETURN TIME AND DATE.

The Forest Service does not automatically initiate searches if a group doesn't exit as planned. Be sure to factor in variables that can delay your return such as wind, waves, fatigue, inclement weather, etc. to prevent unnecessary search and rescues. Remember to check in with family or friends as soon as you exit the wilderness.

BWCAW Commercial Permit Issue Stations

Aurora Area
Forest Service Office – Aurora

Cook/Orr Area
Forest Service Office – Cook
Anderson Canoe Outfitters
Voyageurs Lutheran Ministry
Zup's Fishing Resort & Canoe Outfitters

Duluth Area
Forest Supervisor's Office – Duluth
Frost River
Duluth Pack Store

Ely Area
Forest Service Office – Ely
Boundary Waters Guide Service
Boundary Waters Outfitters
Camp Voyageur, Inc.
Canadian Waters, Inc.
Canoe Country Outfitters
Cliff Wold's Outfitting Co.
Custom Cabin Rental
Ely Outdoors Co.
Girl Scouts of MN & WI–Lakes & Pines
LaTourell's Resort & Outfitters
Moose Track Adventures
North Country Canoe Outfitters
Northern Tier High Adventure B.S.A.
Packsack Canoe Trips & Log Cabins
Piragis Northwoods Company
River Point Resort and Outfitting Co.
Snowbank Lodge and Outfitters
Spirit of the Wilderness Outfitters
Timber Trail Lodge
Voyageur North Outfitters
Voyageur Outward Bound School
Williams and Hall Wilderness Guides & Outfitters
YMCA Camp Widjiwagan

Grand Marais/Gunflint Area
Forest Service Office – Grand Marais
Adventurous Christians
Bearskin Lodge
Clearwater Canoe Outfitters
Gunflint Lodge & Outfitters
Gunflint Pines Resort
Hungry Jack Outfitters
Nor'Wester Lodge & Canoe Outfitters
Rockwood Lodge & Outfitters
Seagull Outfitters and Cabins
Seagull Creek Fishing Camp
Northern Goods
Tuscarora Lodge & Canoe Outfitters
Voyageur Canoe Outfitters
Way of the Wilderness
Wilderness Canoe Base
YMCA Camp Menogyn

Tofte/Isabella Area
Forest Service Office – Tofte
Sawbill Canoe Outfitters
Sawtooth Outfitters

A commercial issue station is a business that has an agreement with the Forest Service to issue BWCAW permits at their location.

For More Information

Forest Service Offices

Forest Supervisors Office, Duluth
(218) 626-4300
www.fs.usda.gov/superior

Kawishiwi Ranger Station, Ely
(218) 365-7600

Gunflint Ranger Station, Grand Marais
(218) 387-1750

Tofte Ranger Station, Tofte
(218) 663-8060

LaCroix Ranger Station, Cook
(218) 666-0020

Laurentian Ranger Station, Aurora
(218) 229-8800

TTY Relay Service:
(800) 627-3529

Tourism Information

Crane Lake Tourism Bureau
(800) 362-7405
www.visitcranelake.com

Ely Chamber of Commerce
(218) 365-6123
www.ely.org

Explore Minnesota
(888) 847-4866
www.exploreminnesota.com

Iron Range Tourism Bureau
(218) 749-8161
www.ironrange.org

Lake Vermilion Resort & Tourism Association
(218) 666-5850
www.lakevermilionresorts.com

Visit Cook County
(888) 922-5000
www.visitcookcounty.com

BWCAW Reservation Center
(877) 444-6777
www.recreation.gov

National Park Service

Grand Portage National Monument
(218) 475-0123
www.nps.gov/grpo/index.htm

Voyageurs National Park
(218) 283-6600
www.nps.gov/voya/index.htm

MN Dept. of Natural Resources

License Bureau
(800) 285-2000

General Information
(888) 646-6367
www.dnr.state.mn.us

bit.ly/BWCAWGuide2023

USDA United States Department of Agriculture

Mapping Wilderness Character in the Boundary Waters Canoe Area Wilderness

James Tricker, Ann Schwaller, Teresa Hanson, Elizabeth Mejicano, Peter Landres

Forest Service

Rocky Mountain Research Station

General Technical Report RMRS-GTR-357

April 2017

EXHIBIT 2

Tricker, James; Schwaller, Ann; Hanson, Teresa; Mejicano, Elizabeth; Landres, Peter. 2017. **Mapping wilderness character in the Boundary Waters Canoe Area Wilderness**. Gen. Tech. Rep. RMRS-357. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 80 p.

Abstract

A GIS-based approach was used to depict how threats to wilderness character vary in extent and magnitude across the Boundary Waters Canoe Area Wilderness. Based on the interagency strategy to monitor wilderness character, *Keeping It Wild: An Interagency Strategy for Monitoring Wilderness Character Across the National Wilderness Preservation System* (Landres et al. 2008a), 53 locally relevant measures were identified by the project core team to capture impacts to the five qualities of wilderness character. These measures were depicted using a variety of spatial datasets, which were normalized using a common relative scale such that disparate metrics could be analyzed together. Each measure was "weighted" by the project core team to reflect its relative impact to wilderness character. Maps generated for each of the weighted measures were then added accumulatively to create a combined map delineating the overall spatial pattern and variation of threats to wilderness character across the Boundary Waters Canoe Area Wilderness. This combined map depicts a wilderness that has not been substantially impacted by threats, with the highest quality wilderness character primarily found away from entry points and travel routes, especially in areas with fewer and smaller lakes; in contrast, the lowest quality wilderness character was highly correlated with lakes that allow motorized use, especially those that are wilderness entry points. The map products presented in this report provide managers with a tool to better understand the extent and magnitude of threats to wilderness character, holistically evaluate tradeoffs associated with decisions and actions in wilderness, and ultimately improve wilderness stewardship.

Keywords: Wilderness Act, wilderness, wilderness character, mapping wilderness character, Boundary Waters Canoe Area Wilderness, Superior National Forest

Cover—River in the Boundary Waters Canoe Area Wilderness (photo by Ann Schwaller).

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Acknowledgments

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Executive Summary

The recent development of an interagency strategy to monitor wilderness character, *Keeping It Wild: An Interagency Strategy for Monitoring Wilderness Character Across the National Wilderness Preservation System* (Landres et al. 2008a), allows on-the-ground managers and decisionmakers to assess whether stewardship actions for an individual wilderness are fulfilling the legislative mandate to "preserve wilderness character." By using credible data that are consistently collected, one can assess how wilderness character changes over time and evaluate how stewardship actions affect wilderness character. As most of these data depict spatial or geographic features in wilderness, a Geographic Information System (GIS)-based approach was developed to depict threats to wilderness character in the Boundary Waters Canoe Area Wilderness (BWCAW).

A set of measures was identified by the project core team to capture impacts to the five qualities of wilderness character (untrammeled, natural, undeveloped, solitude or primitive and unconfined recreation, and other features of value). These measures were depicted using a variety of spatial datasets, which were normalized using a common relative scale such that disparate metrics could be analyzed together. Each measure was "weighted" by the project core team to reflect its relative impact to wilderness character. Maps generated for each of the weighted measures were then added together to produce a composite map of threats to wilderness character. The map products presented in this report delineate the spatial pattern and variation of threats to wilderness character across the BWCAW.

These maps will be used by Superior National Forest staff to inform and support forest plan revisions, Wilderness Stewardship Performance planning, and management decisionmaking. The maps, and this approach, do not represent a determination of significant effects, nor do they endorse specific management decisions or trigger management action. Instead, this project provides managers with a tool to better understand the extent and magnitude of threats to wilderness character across the BWCAW, holistically evaluate tradeoffs associated with decisions and actions in wilderness, and ultimately improve wilderness stewardship.

Foreword

Beginning in 2013, the Superior National Forest partnered with the Aldo Leopold Wilderness Research Institute to develop a map of threats to wilderness character in the BWCAW. The primary goal of this project was to spatially depict how threats to wilderness character vary in magnitude and extent across the wilderness. This project was also intended to improve our understanding of the current condition of wilderness character, contribute to planning efforts by facilitating the evaluation of broad-scale impacts to wilderness character, and create a baseline from which changing threats to wilderness character can be monitored over time. As the first National Forest to map threats to wilderness character for use in future planning efforts, the Superior National Forest has been nationally recognized for our commitment to outstanding wilderness stewardship and received the 2014 Aldo Leopold Award for Overall Wilderness Stewardship Program.

More than 50 people across various disciplines and organizations contributed their expertise, knowledge, and feedback to making this project a success. Internal collaboration spanned a variety of resource fields, including: air, archaeology, botany, ecology, fire/fuels, fisheries, geology, hydrology, law enforcement, recreation, silviculture, soils, wilderness, and wildlife. External consultation included representatives from Federal and State agencies, universities, and non-profit organizations. The highly collaborative nature of this project ensured a comprehensive approach to understanding and spatially representing threats to wilderness character in the BWCAW.

The map products presented in this report provide managers with a valuable tool for understanding how threats to wilderness character vary across the wilderness. While these maps are not an absolute or incontrovertible determination of the condition of wilderness character, they are estimates of selected impacts and limited by the quality and availability of spatial datasets. They represent our best approximation of the threats to wilderness character in the BWCAW. Overall, we consider the map products presented in this technical report to be a vital resource for wilderness managers that will help us understand the myriad effects of actions taken in and adjacent to wilderness, to make thoughtful and informed stewardship and planning decisions, and to improve our effectiveness in preserving wilderness character.

Richard Periman
Acting Forest Supervisor, Superior National Forest

Contents

Figures

Tables

Acronyms and Abbreviations

ALR—Anthropogenic Light Ratio
BWCAW—Boundary Waters Canoe Area Wilderness
CASTNET—Clean Air Status and Trends Network
CMAQ—Community Multiscale Air Quality
dBA—A-Weighted Decibels
DEM—Digital Elevation Model
DHS—Department of Homeland Security
DSM—Digital Surface Model
EPA—Environmental Protection Agency
FSM—Forest Service Manual
GIS—Geographic Information System
HP—Horsepower
MBS—Minnesota Biological Survey
Minnesota DNR—Minnesota Department of Natural Resources
MODIS—Moderate Resolution Imaging Spectroradiometer
NNIS—Non-Native Invasive Species
NPS—National Park Service
NWPS—National Wilderness Preservation System
OHV—Off-Highway Vehicles
PRISM—Parameter-Elevation Regressions on Independent Slopes Model
RAWS—Remote Automated Weather Stations
SNF—Superior National Forest
SNOTEL—Snowpack Telemetry
TIFF—Tagged Image File Format
USGS—U.S. Geological Survey
USDA—U.S. Department of Agriculture

Introduction

The Wilderness Act of 1964 established the National Wilderness Preservation System (NWPS) "for the protection of these areas, [and] the preservation of their wilderness character" (Wilderness Act of 1964, Section 2[a]). In congressional testimony clarifying the intent of wilderness designation, Howard Zahniser (1962) said, "The purpose of the Wilderness Act is to preserve the wilderness character of the areas to be included in the wilderness system, not to establish any particular use"; legal scholars (McCloskey 1999; Rohlf and Honnold 1988) subsequently confirmed that preserving wilderness character is the Act's primary legal mandate. Furthermore, the policies of all four wilderness managing agencies state that they are to preserve wilderness character in all areas designated as wilderness.

The condition of wilderness character varies across a wilderness based on the intensity and distribution of human influences that degrade it (Forest Service Manual [FSM] 2320.6) (USDA Forest Service 2007). Just as variation in other landscape features can be depicted spatially, so too can the condition of wilderness character. Maps depicting spatial variation in wilderness attributes have been produced at a variety of scales: globally (Sanderson and others 2002), continentally (Carver 2010), nationally (Aplet and others 2000), and locally (Carver and others 2008). Adding to this body of work, a recent study for Death Valley National Park (Carver and others 2013; Tricker and others 2012) provided a spatially explicit description of how impacts to wilderness character vary across the Death Valley Wilderness. This approach has been strongly supported by the National Park Service (NPS), and further studies have been conducted for wildernesses within Olympic, Denali, Sequoia and Kings Canyon, Saguaro, and Gates of the Arctic national parks. The Boundary Waters Canoe Area Wilderness (BWCAW) is the first Forest Service administered wilderness for which this approach has been used to develop a map of threats to wilderness character.

The Boundary Waters Canoe Area Wilderness

The BWCAW was one of the original wildernesses designated by the Wilderness Act. First recognized for its unique recreational opportunities in 1926 when it was designated as a primitive area by the Secretary of Agriculture, it was named the Superior Roadless Primitive Area in 1938. Efforts to preserve public recreational opportunities in the area began soon after its establishment. The Izaak Walton League of America established an endowment in 1943 to raise funds for the purchase of private lands in the primitive area, which were then sold to the Forest Service until 1961. Shortly after, the Thye-Blatnik Act of 1948 allowed Federal acquisition of adjacent resorts and other private lands until 1968. An Executive Order issued by President Truman in 1949 also created an air-space reservation of 4,000 feet (the only such reservation held by a wilderness area today). After being renamed as the Boundary Waters Canoe Area in 1958 and designated as wilderness in 1964, additional legislation—the Boundary Waters Canoe Area Wilderness Act of 1978 (Public Law 95-495)—increased the wilderness acreage, terminated logging activity, established the Mining Protection Area, and limited and regulated motorized recreation in the area. Over 17 million federal dollars were spent between 1980 and 1990 to implement the 1978 Boundary Waters Canoe Area Wilderness Act, including funding private land purchases, recreation construction, assistance to resorts, and assistance to communities.

Located in the Superior National Forest (SNF) in northeastern Minnesota, the BWCAW is over 1,098,000 acres in size and extends nearly 150 miles along the international boundary with Canada. Voyageurs National Park, encompassing over 125,000 acres of recommended wilderness, lies directly to the west of the BWCAW, while Canada's Quetico Provincial Park, with over a million acres of land managed as wilderness, lies to the north. Together, these three contiguous areas form a wilderness core of approximately 2.5 million acres in the heart of the North American continent (fig. 1). This core is surrounded by a network of protected lands that include the non-wilderness areas of the SNF, Grand Portage National Monument, and numerous State and provincial parks. Within the SNF, four ranger districts—La Croix, Kawishiwi, Tofte, and Gunflint—administer the BWCAW (fig. 2).

The BWCAW is the only large temperate lake-land wilderness in the NWPS and is renowned for its water-based recreational opportunities. Great glaciers repeatedly scraped and gouged this area over the past 2 million years, leaving behind rugged cliffs and crags, gentle hills, shorelines of exposed bedrock, sandy beaches, and an abundance of rivers and lakes dotted with islands. With several hundred miles of streams and over 1,000 lakes (varying in size from 10 acres to 10,000 acres), approximately 190,000 acres (20 percent) of the surface area of the BWCAW is water. This network of connecting waterbodies provides unique opportunities for long distance travel by watercraft—a rare experience within the continental United States. Around the lakes and rivers, a mix of wetlands, boreal forest, and temperate hardwoods provides habitat for iconic north woods species such as wolves, black bears, bobcats, lynx, moose, beavers, loons, bald eagles, and peregrine falcons.

Humans have been occupying and visiting the area that is now the BWCAW for millennia. Archaeological sites dating back over 10,000 years attest to the long history of human presence in this area. More recent cultural resource sites provide glimpses of the beginning of European contact with Native Americans, the fur-trade and the voyageurs, the period of logging, mining, and settlement, and the work of early managers including the Forest Service and the Civilian Conservation Corps. Visitors today enjoy similar experiences and opportunities to those that came generations before, connecting them to the past as they contribute to the enduring human relationship with the land.

The BWCAW is one of the most popular wilderness areas in the country and receives approximately 150,000 visitors each year. To accommodate the high recreational use, it contains 67 entry point locations with access to over 1,200 miles of canoe routes, 12 hiking trails, and nearly 2,000 designated campsites (each with a latrine and fire grate). Opportunities for canoeing, kayaking, camping, hiking, fishing, and hunting abound in summer and fall, while winter visitors can enjoy ice fishing, skiing, snowshoeing, and dogsledding. The wilderness offers freedom to those who wish to pursue an experience of expansive solitude, personal challenge, and connection with nature.

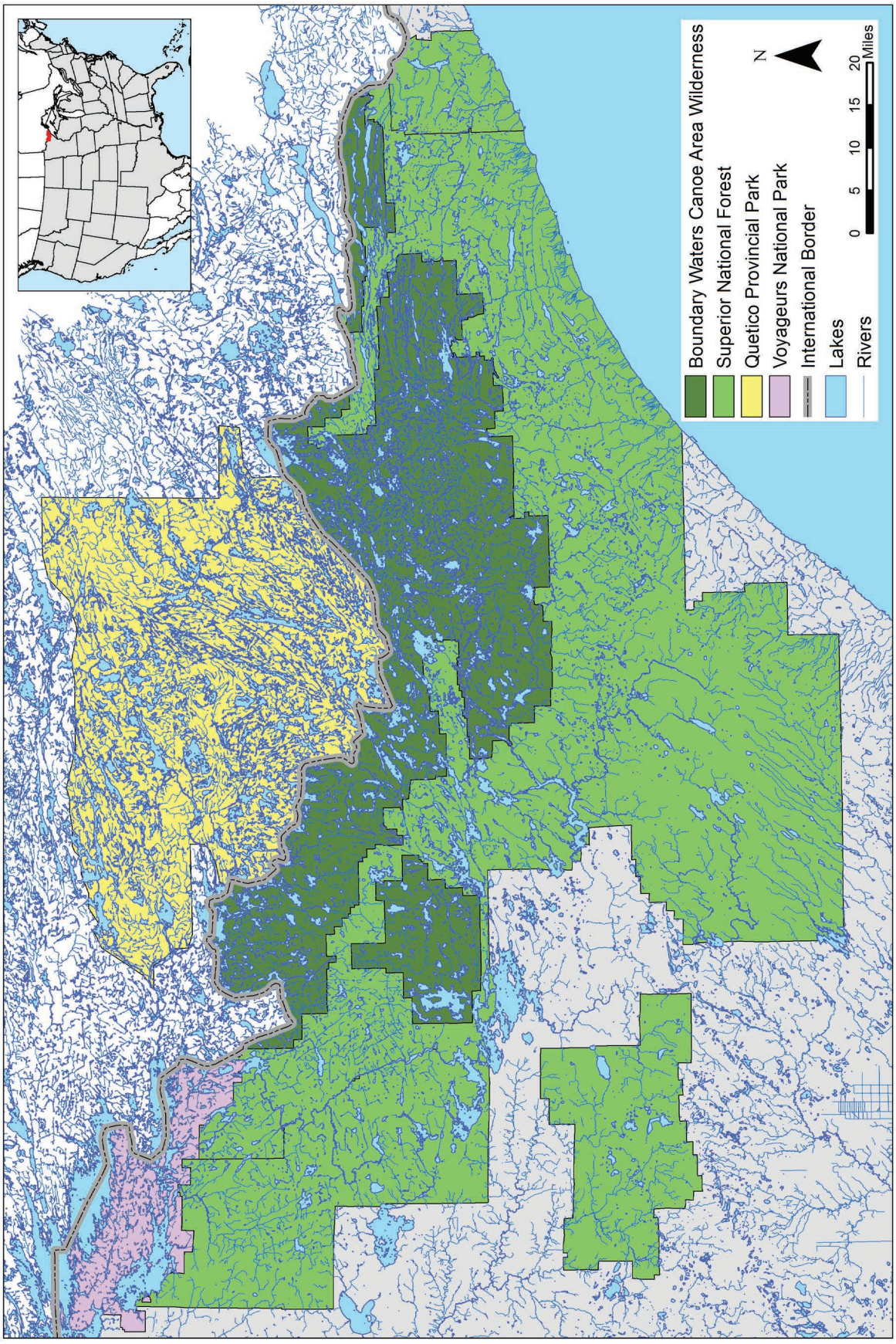

Figure 1—The BWCAW and surrounding protected areas.

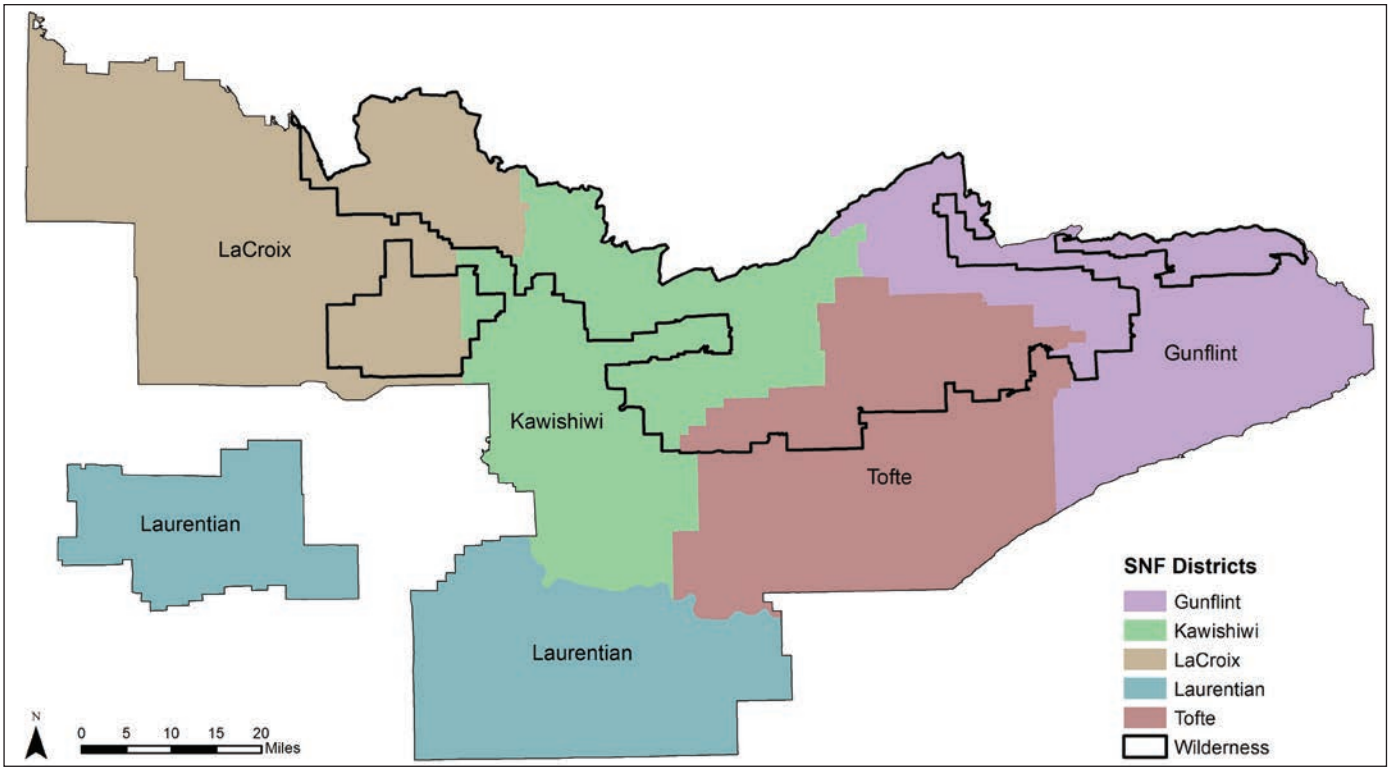

Figure 2—Ranger districts of the SNF and BWCAW.

Purpose of This Mapping Project

The purpose of this project was to develop an approach that spatially depicts threats to wilderness character in the BWCAW and how they vary across the wilderness. This mapping effort:

- Shows the current extent and magnitude of threats to wilderness character and how they vary across the BWCAW;
- Provides a measurement baseline from which future monitoring can show how threats to wilderness character change spatially over time;
- Allows the SNF to analyze the potential impacts of different management actions on wilderness character;
- Identifies areas within the wilderness where resource managers should make an effort to control or mitigate impacts, including monitoring conditions, establishing thresholds, or taking direct action;
- Identifies specific activities or impacts outside the wilderness that may pose a substantial risk of degrading wilderness character inside wilderness;
- Improves internal staff communication about wilderness and wilderness character and improves external communication between the forest and the public on related issues; and
- Identifies and fills data gaps by collecting information from local staff and digitizing new spatial data.

In addition to the immediate benefits described above, this project improved and consolidated existing spatial datasets and generated new datasets. These datasets, and the maps produced by this project, lay the groundwork for future wilderness character mapping efforts in the BWCAW. When and if the SNF is able to conduct future iterations of the map of threats to wilderness character, the maps in this report can serve as the baseline for assessing how threats to wilderness character change spatially over time.

Concerns and Cautions

There are a number of potential concerns about producing maps of threats to wilderness character. Despite these concerns, managers have recognized these maps as the best available tool for spatially representing impacts to wilderness character. Following are some major cautions to consider about this overall effort.

- *Creating sacrifice zones*—The map may facilitate the inappropriate creation of "sacrifice zones" or internal buffers within the wilderness, directly contravening congressional and agency mandates to preserve wilderness character across an entire wilderness. For example, if the map shows that some areas are "better" or of "higher quality" than others, the tendency may be to focus efforts on preserving wilderness character only in these specific areas while allowing wilderness character to degrade in "lower quality" areas. Forest Service wilderness policy explicitly prohibits this by stating: "Do not maintain internal buffer zones that degrade wilderness values" (FSM 2320.3) (USDA Forest Service 2007). By showing the current extent and magnitude of threats to wilderness character and how they vary across the entire wilderness, the intent of the map is to help staff maintain high quality areas while improving lower quality areas.

- *Comparing wilderness character among wildernesses*—Since this approach has been used for other wilderness areas, the map may facilitate inappropriate comparisons of wilderness character among different wildernesses. These maps show the current extent and magnitude of threats to wilderness character in different colors (representing pixel values), and it would be easy for users to compare the quantity of a given color from one wilderness to another. Comparing these maps among different wildernesses, however, is neither valid nor appropriate because each map is built with data from the unique context of a particular wilderness.

- *Assuming that the resulting map completely describes wilderness character*—The map may be misconstrued as an accurate and precise description of wilderness character. The map is instead only an estimate of selected threats to wilderness character for which spatial data were available for this particular wilderness. As an approximate representation of threats to wilderness character, the map should not be considered an absolute and complete description. In addition, the map does not portray the threats to the symbolic, intangible, spiritual, or experiential values of wilderness character. In short, while this map is useful for the purposes outlined above, it does not describe the complexity, richness, or depth of wilderness character.

- *Updating datasets in the future such that maps are not directly comparable*—As datasets are updated over time, future iterations of the map may not be comparable

with the original map. Each map is a product of both the best available spatial data and the locally defined methods for processing those data. As with all long-term monitoring efforts, changes in the type and quality of data or in the data processing techniques can make comparisons between original and subsequent data invalid. Therefore, proposals to use new or altered data, or to change data processing methods, need to be assessed carefully to ensure the comparability of map products over time.

Report Outline

A team approach was used to develop the map of threats to wilderness character in the BWCAW, tapping the experience and knowledge of SNF staff (see page ii for a full list of staff involved). Together, the project core team and other SNF staff have more than 400 person-years of on-the-ground experience in and with the BWCAW. The project core team, and other SNF staff as required, conducted many face-to-face meetings and had numerous phone and email conversations while developing the map products described in this report. All decisions about developing the map were made by project core team consensus.

This report provides an in-depth discussion of how the map of threats to wilderness character was developed. It is divided into three major sections:

- *Overview of the Process for Developing the Map of Threats to Wilderness Character* describes the conceptual foundation for how the map was developed.
- *Methods* describes the measures that were used to represent the degradation of wilderness character, along with the data sources, data processing methods, data and measure cautions, and the rationale for measure weighting.
- *Map of Threats to Wilderness Character* discusses some of the patterns revealed in the map, approaches to improving map development in the future, and final concerns about the overall process.

Overview of the Process for Mapping the Threats to Wilderness Character

This wilderness character mapping project used a Geographic Information System (GIS) to spatially describe and assess impacts to wilderness character in the BWCAW. With this approach, it is essential to understand the variety of activities and influences that "threaten" wilderness character, as well as the role of wilderness managers in mitigating or responding to such threats. In the BWCAW, there has been, and continues to be, a substantial amount of human influence—ranging from a long history of human use and resource extraction, to current high visitation levels, to reasonably foreseeable future impacts from climate change. Although the BWCAW is far from being considered a "pristine" or "pure" wilderness, managers are nevertheless tasked with protecting and preserving its wilderness character from further degradation. As stated in Forest Service policy: "Each designated wilderness is affected by a variety of human influences that vary in intensity. …The goal of wilderness management is to identify these influences, define their causes, remedy them, and close the gap…between the attainable level of purity and the level that exists on each wilderness" (FSM 2320.6) (USDA Forest Service 2007). Only by understanding the myriad human influences that affect—or "threaten"—wilderness character can managers meet wilderness stewardship goals.

For this report, "threats" to wilderness character are defined as a combination of

- Historical activities that continue to degrade wilderness character (e.g., historical logging activity, departure from natural fire regimes);
- Current actions or influences that degrade wilderness character (e.g., non-native invasive species, administrative motorized/mechanized use); and
- Impending issues that are likely to degrade wilderness character into the future (e.g., change in winter temperature, night sky obfuscation).

By identifying and depicting threats to wilderness character, the maps produced in this report provide managers with a tool to better understand the extent and magnitude of impacts to wilderness character in the BWCAW and thereby improve wilderness stewardship.

This project adheres to the interagency strategy for monitoring wilderness character, as described in *Keeping It Wild: An Interagency Strategy for Monitoring Wilderness Character Across the National Wilderness Preservation System* (Landres and others 2008a)[1]. The *Keeping it Wild* monitoring strategy was formally endorsed in 2009 by the Interagency Wilderness Policy Council (which is composed of the highest policy-level personnel responsible for wilderness in each of the four wilderness managing agencies).

[1] An updated interagency wilderness character monitoring strategy, described in *Keeping it Wild 2: An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System* (Landres and others 2015), was released in October 2015 prior to the publication of this report. While this project was based on the original *Keeping it Wild*, early and final drafts of *Keeping it Wild 2* were used for additional clarification and guidance in writing the report.

Therefore, by adhering to the interagency strategy, this project is consistent with Forest Service and interagency policies, terminology[2], and monitoring protocols for wilderness character.

The Five Qualities of Wilderness Character

Keeping It Wild provides a tangible definition of wilderness character and identifies four qualities of wilderness character that apply uniquely to every wilderness: untrammeled, natural, undeveloped, and solitude or primitive and unconfined recreation. These qualities apply to all designated wilderness areas because they are based on the legal definition of wilderness from the Wilderness Act (1964, Section 2[c]). In addition to these four qualities, a fifth quality—other features of value—was also used for this project based on the last clause of Section 2[c] in the Wilderness Act: a wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic or historical value" (Landres and others 2012, 2015).

Actions managers choose to take—or not take—in wilderness have the potential to degrade or improve these qualities and affect wilderness character. Challengingly, actions taken to protect or improve one quality of wilderness character may often result in the degradation of another quality (Landres and others 2008a, 2015). For example, although maintaining latrines at campsites protects water quality and benefits the natural quality, the latrines are also facilities that decrease opportunities for primitive recreation and installations that diminish the undeveloped quality. These types of tradeoffs are inherent to many aspects of wilderness stewardship, and understanding how a single action may have different effects on the qualities of wilderness character is essential for evaluating management decisions and actions in wilderness.

In addition to the actions, or inaction, of managers, wilderness character may also be affected by factors outside the jurisdiction of the Forest Service. For example, air pollution, night sky light pollution, and climate change are not under the direct control of wilderness managers but can still have substantial effects on the qualities of wilderness character. The inclusion of these types of external impacts in the interagency wilderness character monitoring strategy (and, consequently, in this mapping project) does not constitute an application of wilderness laws, policies, and restrictions to non-wilderness areas (i.e., the creation of a "buffer" around wilderness); instead, it is an acknowledgment that broad-scale social and ecological changes may affect wilderness character (Landres and others 2008a, 2015). As stated in Forest Service policy, "Because wilderness does not exist in a vacuum, consider activities on both sides of wilderness boundaries during planning" (FSM 2320.3) (USDA Forest Service 2007).

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[2] Terminology used in this report to describe threats to wilderness character—including "degraded," "negative impact," "significant," etc.—reflects common vocabulary used in laws, policies, and interagency wilderness character monitoring documents. These terms do not imply an analysis of impacts or determination of significant effects, such as required by the National Environmental Policy Act or other agency decisionmaking processes.

Certain activities may be legally allowed in wilderness and yet also threaten wilderness character. Although the Wilderness Act prohibits "nonconforming" uses (such as motorized use, mechanical transport, or the installation of permanent developments), specific exceptions have been permitted through special provisions in the Wilderness Act itself and in subsequent wilderness legislation (such as the Boundary Waters Canoe Area Wilderness Act of 1978). The Wilderness Act (1964, Section 4[c]) states that nonconforming uses or activities may be permitted only "as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area)." Additional special provisions may also be legislated for a specific wilderness to allow, or require, nonconforming activities by managers or visitors. Even in situations where such uses are both legal and justifiable, however, nonconforming activities still degrade wilderness character (Landres and others 2005, 2008a, 2015). This is supported by Forest Service wilderness policy, which states, "In wildernesses where the establishing legislation permits resource uses and activities that are nonconforming exceptions to the definition of wilderness as described in the Wilderness Act, manage those nonconforming uses and activities in such a manner as to minimize their effect on the wilderness resource" (FSM 2320.3) (USDA Forest Service 2007). Over time, the cumulative effects of these legal yet nonconforming uses may cause a substantial impact to wilderness character, which emphasizes the need to carefully weigh future decisions related to such activities.

The Mapping Framework

The five qualities of wilderness character form the foundation of the interagency monitoring strategy and are the first level of the hierarchical monitoring framework. As described in *Keeping it Wild*, this framework divides wilderness character into successively finer components: the qualities of wilderness character are divided into a standard set of indicators[3], which are monitored in turn through a set of locally relevant measures[4]. For this project, measures were selected by the project core team to represent threats to wilderness character in the BWCAW. Individual measures were mapped using spatial datasets and weighted to reflect their respective influences on wilderness character. Maps of the measures were then added accumulatively using these weights to create maps of the indicators and qualities, as well as an overall map of threats to wilderness character in the BWCAW (fig. 3).

For this mapping project, measures were explicitly selected to represent features, conditions, and actions that threaten wilderness character in the BWCAW. For example, the authorized developments measure depicts where the undeveloped quality has been degraded by the presence of permanent installations. While some actions, conditions, or features in wilderness may have a positive influence on wilderness character (such as the preservation of an endangered keystone species), such "value added" features are

[3] Indicators are distinct and important elements within each quality of wilderness character. They have measurable attributes that can be the focus of wilderness character monitoring efforts.
[4] Measures are specific and tangible aspects of an indicator that can be measured to gain insight into the status of the indicator and to assess trends over time.

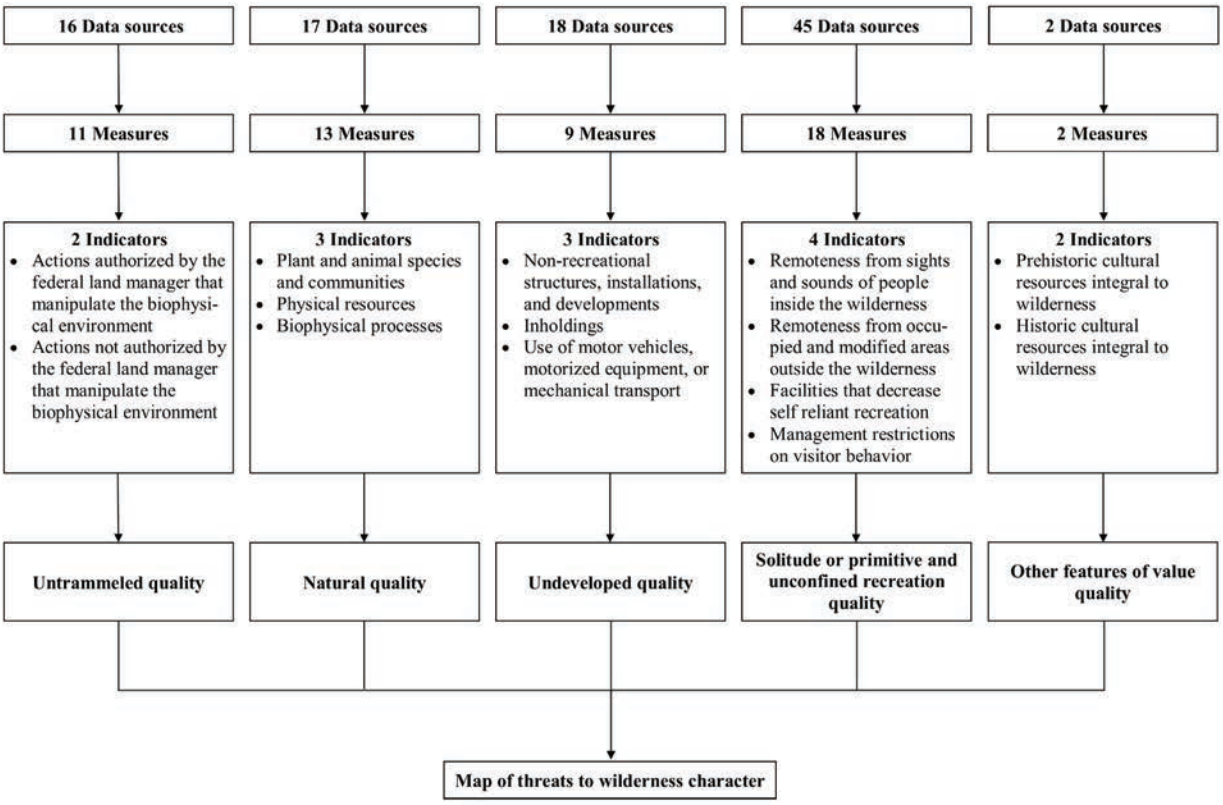

Figure 3—Flow chart of the framework used for mapping threats to wilderness character.

not encompassed by the selected measures. Similarly, when actions or features have a mix of both positive and negative effects (such as management regulations that confine visitors in order to protect natural resources), the selected measures only quantify the negative impacts. The BWCAW project core team decided to adopt this "negative mapping" approach because it allows for the full magnitude of threats to be depicted. In contrast, simultaneously displaying positive and negative impacts on a single map would result in these opposing influences being mutually offset or cancelled out, thereby obscuring the true extent of their individual effects on wilderness character. Therefore, the map products presented in this report only depict threats to wilderness character and do not capture management activities that benefit or improve wilderness character.

At first glance, it could appear inappropriate or meaningless to combine measures into a single overall map since each measure captures a unique and distinct impact to wilderness character. For example, it may seem counterintuitive to combine the areal extent of invasive plants with the probability of encounters with other visitors. However, since all measures quantify threats to wilderness character, combining measures is both appropriate and important for understanding and recording the magnitude of their cumulative effects. Additional information on the rationale and methods for accumulatively combining disparate measures to produce an overall map of threats to wilderness character are described by Carver and others (2013). While data and maps for individual measures are relevant for local management purposes, the intent of this mapping project is also to understand and report on the big picture—to represent the

cumulative spatial pattern and variation of threats to wilderness character. This big picture is a powerful and effective tool for communicating wilderness issues within the agency and with external audiences (Landres and others 2008b).

Mapping threats to wilderness character differs from wilderness character monitoring in a key way. While monitoring efforts focus on assessing change in wilderness character over time by producing a single overall trend direction (i.e., improving/upward, stable, or degrading/downward), this mapping project examined the current (baseline) extent and magnitude of threats to wilderness character and how those cumulative threats vary across the wilderness. The overall map of threats to wilderness character was therefore generated directly from the weighted measures, and it did not undergo a standardization process at each level of the hierarchical framework (as is the case when deriving trends for wilderness character monitoring). This approach allowed the magnitude of threats to be depicted so that qualities with few or lightly weighted measures (i.e., fewer or milder threats) had a proportionally smaller influence on the overall map of threats to wilderness character than qualities with many or heavily weighted measures (i.e., more or greater threats).

The maps produced through this project depict the BWCAW's current degree of departure or degradation from an "optimal condition" of wilderness character. This optimal condition reflects an ideal manifestation of wilderness character as expressed in the Wilderness Act—in other words, a state in which there are no threats to wilderness character. Each measure is depicted across the wilderness on a scale from its "optimal condition" (i.e., no threat) to its most "degraded condition" (i.e., highest current threat level). When the measures are combined accumulatively, therefore, the overall map of threats to wilderness character is similarly depicted on a scale from its optimal condition (i.e., no threats to wilderness character) to its most degraded condition (i.e., highest cumulative threat level from all measures). The optimal conditions depicted in the map products do not represent the condition of wilderness character in the BWCAW in 1964 or in 1978, and therefore cannot be used to determine if threats to wilderness character have increased or decreased since the time of designation.

Methods

Selecting measures under each indicator of the five qualities was an iterative and collaborative decisionmaking process. Possible measures were first identified by the project core team and then evaluated for both their relevance to the indicator and the availability and quality of the required data. SNF staff assessed data quality for each dataset using two metrics: accuracy (how well the dataset represents the measure) and completeness (how complete the dataset is across the wilderness). In general, only measures that were relevant, and that had readily available data of sufficient quality, were included. For certain measures this involved developing new datasets based on institutional knowledge (i.e., drawing known locations of impacts onto paper maps, which were then digitized by Teresa Hanson, SNF GIS Analyst). In some cases, potential measures had insufficient or non-existent data but were acknowledged by SNF staff for their significance to their respective indicators; these "data gap" measures are noted below under each applicable quality. As data improve or become available, the data gap measures should be reevaluated for inclusion in future iterations of the map of threats to wilderness character.

Weighting Measures

Once all measures were selected, each was evaluated independently to determine the magnitude of its effect on wilderness character. Some measures have a greater impact to wilderness character than others; for example, the shoreline erosion measure has a relatively smaller impact (because it only occurs at one location), whereas the departure from natural fire regimes measure has a relatively greater impact (because fire suppression is widespread and causes blowdowns, tree species changes, and fuel buildup). To accurately portray the variable magnitudes of the measures' effects, each measure was assigned a "weight" —a value from 1 (low impact) to 10 (high impact)—by the project core team. The project core team then reviewed the map outputs and modified the weighting scheme to reflect their knowledge of the condition of wilderness character on the ground. While this interactive process runs the risk of allowing staff to "game the system" to produce a desired outcome, staff experience has been shown to be highly accurate in judging resource conditions (Cook et al. 2009). The project core team used caution and consensus-driven oversight to ensure accuracy in the maps produced.

Specific rationales for weights assigned to each measure can be found in tables 2, 4, 6, 9, and 11 under their respective qualities. The following questions were used to help determine weights for all measures:

- Is the measure specific to a particular area (lower weight) or spread throughout the wilderness (higher weight)?
- Does the measure represent a major management issue, e.g., suppressed fires (higher weight), or is it something relatively benign, e.g., boundary markers (lower weight).
- Does the measure depict an emerging threat that requires intensive management, e.g., the spread of non-native invasive species (higher weight), or does it depict

an issue that has largely been solved and is no longer of high concern to management, e.g., sulfur deposition (lower weight)?

- Is the measure relevant to a particular time of year or season (lower weight), or is it an issue year-round (higher weight)?
- Are the data representing the measure accurate and complete (higher weight) or are they of poorer quality (lower weight)?
- Are the data qualitative (lower weight) or quantitative (higher weight)?

Data Sources and Processing Techniques

Measures were mapped by applying GIS-based techniques to their respective datasets. A total of 87 datasets were used for measuring and delineating threats to wilderness character in the BWCAW. These datasets were obtained from a variety of sources and comprised local, regional, and national spatial data at varying scales, accuracy, and completeness. This variation placed limitations on how the map products were developed and necessitated the use of adaptable data processing methods, as described below. Metadata were developed for each data layer used in this mapping project and include documentation of processing flows, quality/completeness, editing, development, and cautionary notes. All data and metadata were organized and stored on a network drive to ensure accessibility and facilitate use in future analyses. Datasets included

- Commonly used data layers that are stored in the SNF's Spatial Reference Library (a centrally located geospatial repository that is accessible to SNF staff);
- Existing data layers associated with previous or ongoing SNF projects;
- Existing datasets that were edited, combined, or refined as a prerequisite for use in this project; and
- Original datasets that were developed from local sources (including records, reports, and expert knowledge) and converted into a geospatial format.

A number of basic processing tasks were performed using ArcGIS[5] for datasets before they were used as measures to create the map of threats to wilderness character. All datasets were projected in ArcGIS using the NAD 1983 UTM Zone 15N coordinate system. For vector[6] datasets, a value was assigned to each feature by the project core team to represent its spatial impact in the BWCAW. Some of the vector datasets had features with a range of values because of the data they represent; for example, under the authorized developments measure, small markers and plaques were ranked with a value of 1, larger dams and docks with a value of 2, and functional structures with a value of 3. The vector datasets were then converted to raster grids[7] whereby locations of the features or their associated effects were represented by the assigned values; unaffected areas of the wilderness (i.e., where no degradation occurs) were set to a value of 0.

[5] GIS software developed by Environmental Systems Research Institute.
[6] Vector data type uses points, lines, and polygons to represent features.
[7] Raster data type consists of rows and columns of cells, with each cell storing a single value.

The values for all raster grid layers were normalized[8] by stretching them to a standardized range of values (0–255). This normalized range of values allows datasets, and therefore measures, to be evaluated together on a common relative scale (Carver and others 2008). For example, the campsite noise inside wilderness and nitrogen deposition measures use different units (decibels vs. parts per billion) and cannot be directly compared without normalization. Lower values of normalized measures were used to represent optimal conditions (i.e., no threat) and higher values to represent degraded conditions (i.e., high threat level).

In the following sections, the measures and datasets used are described for each of the five qualities of wilderness character. Measures are organized by their weight within each quality, with higher weighted measures listed first. For each measure included in this analysis, the specific data sources, processing, and cautions are also described. All datasets and measures used the units of the original data source(s); throughout this report, metric units (e.g., kilometers) and imperial units (e.g., miles) are used interchangeably. The maps represent a grid of values (approximately 5 million pixels at a 30-meter resolution) and use a blue-red color ramp and the "minimum-maximum" stretch method[9] to enhance the color contrast; areas of optimal condition (no threat) are shown in blue, while areas of degraded condition (high threat level) are shown in red.

[8] Normalization of measures was achieved using a linear rescaling of the input values (slicing) onto a 0–255 scale on an equal interval basis.

[9] The stretch method defines the type of histogram stretching that was applied to raster datasets to enhance their appearance. The minimum-maximum stretch applies a linear stretch on the output minimum and output maximum pixel values, which were used as endpoints for the histogram (ESRI 2015).

Untrammeled Quality

The untrammeled quality focuses on the degree to which wilderness is unhindered and free from modern human control or manipulation. The untrammeled quality is degraded by actions that intentionally manipulate or control ecological systems (in contrast to the natural quality, which is degraded by the *effects* of modern civilization) (Landres and others 2008a, 2015).

To spatially depict the baseline of threats to untrammeled quality in the BWCAW, the project core team decided to provide a cumulative summary of all trammeling actions from 1978 (the year of the Boundary Waters Canoe Area Wilderness Act) to 2014. While some measures had data available for the entire 37-year period, other measures did not; in these cases, the most recent complete datasets were used instead.

Indicators and Measures

Keeping it Wild delineates two indicators under the untrammeled quality. The measures selected for the BWCAW are described below for each of these indicators. No data gap measures were identified for this quality.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

- Suppressed fires—Locations where naturally ignited fires were suppressed. Wildfires are natural ecosystem processes and their suppression interferes with the biophysical environment. Fire suppression occurs either across the areal extent of a fire or along a particular front. The SNF has been suppressing naturally ignited fires since its establishment in 1909. From 1994 to 2013 there were 14 large wildfires in the BWCAW that received a suppression response.
- Fish stocking—Lakes where fish stocking has occurred. The intentional introduction of native or non-native species is a manipulation of the wilderness and its community of life. Since the 1930s, the Minnesota DNR has been stocking fish in the area that is now the wilderness. While species that were stocked before 1978 and have survived to the present day are now considered to be indigenous, the act of bringing native *or* non-native animals into the wilderness is still a trammeling action. From 1988 to 2013, 72 lakes were stocked with fish; species stocked included lake trout, brook trout, rainbow trout, and walleye.
- Prescribed fires—Areas burned by prescribed fires. Prescribed burns are used to deliberately manipulate vegetation communities and influence fire regimes. In the BWCAW, prescribed burns are intended to help offset decades of fire suppression. From 2000 to 2013, 21 prescribed fires were ignited in the wilderness.
- Fish surveys—Lakes where fish surveys have been conducted. Surveys of fish and wildlife interfere with animal communities and cause significant stress or mortality for the individuals captured. Surveying lakes for fish can involve setting nets with buoys, angling, seining, and/or electrofishing. The Minnesota DNR has been conducting fish surveys in what is now the wilderness since the 1930s; from 1978 to 2013, the DNR surveyed 396 lakes.

- Non-native plant treatments—Locations where non-native invasive plants were treated manually and chemically. The intentional treatment or removal of plants, especially in significant numbers, purposefully alters vegetation communities. Most non-native terrestrial plants in the wilderness are restricted to disturbed areas such as trails, portages, campsites, and burned areas. From 2009 to 2013, non-native invasive plants were treated at 1,781 locations in the BWCAW; the majority of these locations were treated by hand-pulling or cutting plants.
- Dam water level manipulation—Active dams affecting water levels. Dams allow humans to manipulate wilderness hydrology by controlling water flow, which can affect flow regimes, channel shape, sediment transportation, water temperature and chemistry, and shoreline erosion. Out of 31 dams in the BWCAW, only a limited number are still functioning and impounding water. Of these, only two—the Fall Lake and Prairie Portage dams—are still active and causing fluctuations in water levels.
- Animal manipulation—Locations of beaver and wolf captures by authorized agencies. Trapping wildlife causes significant stress to individual animals and interferes with the community of life in wilderness. Two species are trapped by authorized agencies in the BWCAW: the Minnesota DNR traps and removes beavers, and the USGS captures wolves. Beaver removal was conducted on Big Rice, Little Rice, La Pond, Duck, Muskeg, Hula, and Wood lakes from 2006 to 2012 to improve waterfowl habitat. From 2005 to 2014, 183 wolves were captured (and some collared) for research purposes, mainly on the east side of the Kawishiwi District and the west side of the Tofte District.
- Soil disturbance—Locations where significant authorized soil disturbance has taken place since 1964. Soil disturbance involves the movement or removal of earth and rocks, and it alters the natural environment. In the BWCAW, the primary causes of significant soil disturbance are actions associated with the construction, maintenance, and restoration of authorized visitor facilities; examples of these types of activities include bridge or boardwalk installation, retaining wall construction, shoreline stabilization, and other actions taken to prevent resource damage on portages and campsites. Exploratory drilling also occurred from 1964 to 1978 and produced seven drill holes on the eastern side of the wilderness.
- Fish spawn collection—Lakes where fish spawn have been collected. The collection and removal of fish and wildlife—including spawn—causes stress to trapped and handled individuals and is a direct manipulation of the biophysical environment. Spawn collection is conducted by the Minnesota DNR and involves corralling fish using weirs, handling fish to extract their eggs, and removing spawn from the wilderness. Lake trout spawn have been tested and/or taken from Gillis Lake (from 1980 to 2008) and Mountain Lake (from 2002 to present).

Indicator: Actions not authorized by the Federal land manager that manipulate the biophysical environment.

- Vandalism of natural resources—Known locations where visitors intentionally manipulated or vandalized natural resources. Visitor actions to deliberately harm or destroy vegetation and other natural resources are a manipulation of

the wilderness environment. In the BWCAW, violations are regularly recorded for visitors who have intentionally cut live vegetation, widened campsites, damaged living trees (e.g., by peeling, carving, or hacking at the bark), or otherwise manipulated the biophysical environment. The vast majority of these types of violations occur at designated campsites (which constitute less than 40 acres of the wilderness); while these areas suffer from repeated vandalism, the remainder of the wilderness is virtually unscathed. From 2009 to 2013, 822 violation notices were written for 224 locations in the wilderness.

- Poaching—Lakes where illegal hunting, trapping, or fishing violations have been recorded by law enforcement. Poaching impacts wildlife and manipulates the community of life in wilderness. While capturing and/or removing animals for any purpose is generally considered a trammeling action, legal hunting, trapping, and fishing were not included under this quality because of their positive associations with primitive recreation and subsistence use in the wilderness. Citations for hunting, trapping, or fishing without the appropriate permit or license are relatively infrequent in the wilderness due to the difficulties of patrolling such a large and heavily used area. Violation notices for illegal poaching were written for 71 locations from 2009 to 2013.

Data Sources, Processing, and Cautions

The datasets used to create the untrammeled quality map are all vector data, of fine scale, and generally of moderate to high accuracy and completeness (table 1). The data sources, data processing information, and cautions are listed below for each measure.

Table 1—Untrammeled quality datasets. Accuracy (how well the dataset represents the measure) and completeness (how complete the dataset is across the wilderness) were evaluated for each measure by SNF staff familiar with these data.

Measure	Source	Type	Scale	Accuracy	Completeness
Suppressed fires	(1) FireSuppression_LN; (2) FireSuppression_PL	Polyline and Polygon	1:24,000	High	High
Fish stocking	BWCAW_StockedLakes1988_2013	Polygon	1:24,000	High	Medium
Prescribed fires	PrescribedFiresBWCAW2000_2013	Polygon	1:24,000	High	High
Fish surveys	BWCAW_DNR_SurveyLakes1978_2013	Polygon	1:24,000	High	High
Non-native plant treatments	(1) Planned2014BWCAWweedTreatments; (2) TreatedWeedPointsBWCAW2009_2013	Point	1:12,000	High	High
Dam water level manipulation	BWCAW_NHD_Waterbody	Polygon	1:24,000	High	High
Animal manipulation	(1) BeaverTrappingPoint; (2) WolfCapturePoints	Point	1:24,000	Medium	Medium
Soil disturbance	(1) DisturbedManipulated_PT; (2) DisturbedManipulated_LN; (3) DrilHolesBWCAW	Point and Polyline	1:63,360	Medium	Medium
Fish spawn collection	BWCAW_SpawnTake	Polygon	1:24,000	High	High
Vandalism of natural resources	VandalismFromLEO_Report2009_2013	Point	1:40,000	Low	Low
Poaching	PoachingLakesBWCAW2009_2013	Polygon	1:24,000	Low	Low

Suppressed fires

- *Sources*—(1) Polyline dataset of the SNF fire history geodatabase (Patty Johnson, SNF Prescribed Fire and Fuels Management Officer); (2) polygon dataset of the SNF fire history geodatabase. These datasets were created by relating institutional knowledge of the locations of fire suppression activities (Patty Johnson, SNF Prescribed Fire and Fuels Management Officer) to the SNF fire history geodatabase; SNF staff assessed the original fire polygons from the SNF fire history geodatabase to determine whether fires were suppressed over the entire polygon, over some portion of the polygon, along the entire polygon perimeter, or along some portion of the polygon perimeter. These datasets represent the SNF fire history from 1994 to 2013.
- *Processing*—Locations of suppressed fires were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—The locations of where specific suppression actions are taken on a fire are not regularly recorded, collected, or stored for the SNF. The dataset created for this measure was based on the local knowledge of forest and district staff; therefore, fires that occurred prior to the employment of current personnel (i.e., fires for which spatial information on suppression actions was not available) were not included in this measure. In addition, some of the spatial descriptions from district staff required interpretation by Teresa Hanson, SNF GIS Analyst, and Ann Schwaller, SNF Wilderness Specialist, and therefore may not directly represent the suppression locations. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Fish stocking

- *Sources*—Polygon dataset of lakes stocked with fish, created by relating fish stocking records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov). Within the fish stocking database, stocking records for the BWCAW were only available starting in 1988.
- *Processing*—Locations of stocked lakes were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Prescribed fires

- *Sources*—Polygon datasets of prescribed fires, derived from the SNF fire history geodatabase (Patty Johnson, SNF Prescribed Fire and Fuels Management Officer). This feature class is updated annually with inputs from the SNF district fire reports.
- *Processing*—Locations of prescribed fires were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Fish surveys

- *Sources*—Polygon dataset of lakes surveyed for fish, created by relating fish surveying records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov). Only fish surveying records from 1978 to 2013 were used for this measure.
- *Processing*—Locations of surveyed lakes were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Non-native plant treatments

- *Sources*—Point dataset of treatment locations for non-native plants from 2009 to 2014 (Jack Greenlee, SNF Plant Ecologist).
- *Processing*—Locations of non-native plant treatments were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Dam water level manipulation

- *Sources*—Point dataset of known old dams within the SNF boundary. Dams that actively manipulate water levels were selected from the original dataset (Marty Rye, SNF hydrologist).
- *Processing*—Locations of dams were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Animal manipulation

- *Sources*—(1) Point dataset of beaver removal locations (Dawn Plattner, Minnesota DNR Assistant Wildlife Supervisor); (2) point dataset of wolf captures (Shannon Barber-Meyer and David Mech, USGS Wildlife Biologists). Wolf capture locations were derived by relating a database containing date and location data for wolf capture to written descriptions of trap line loops or routes.
- *Processing*—Locations of beaver removal and wolf trapping were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—The wolf capture points represent approximate locations based on the information in the capture database (generally described to the quarter section—160 acres) and the descriptions of the trap line routes provided by the researchers (e.g. “the traps were placed about halfway along the portages”). Bear dispatch—a trammeling action that manipulates animals—was not included for this measure because data were unavailable. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Soil disturbance

- *Sources*—(1) Point dataset of restoration activities (SNF District Wilderness Staff); (2) polyline dataset of restoration activities (SNF District Wilderness Staff); (3) point dataset of exploratory drilling sites (Jon Van Alstine, SNF Geologist). For restoration activities, SNF District Wilderness Staff were given 1:63,360 scale base maps that they used to indicate line or point features within the BWCAW that have received considerable restoration efforts and/or contain improvements such as boardwalks, retaining walls, shoreline stabilization features, etc.
- *Processing*—All locations were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—Soil disturbance from road building during logging eras was not included for this measure because data were unavailable. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Fish spawn collection

- *Sources*—Polygon dataset of lakes where fish spawn collection occurred, created by relating spawn collection records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov).
- *Processing*—Locations of fish spawn collection were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Vandalism of natural resources

- *Sources*—Point dataset of natural resource vandalism, derived from the law enforcement reported incidents database (Trish Beaudry, SNF Law Enforcement Program Assistant).
- *Processing*—Locations of vandalism were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The NAD83 datum was assumed for the geographic coordinates in the original table. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Poaching

- *Sources*—Polygon dataset of poaching violations, created by relating information from the law enforcement reported incidents database (Trish Beaudry, SNF Law Enforcement Program Assistant) and the Minnesota DNR fishing violations database (Bruce Anderson, Minnesota DNR Assistant Wildlife Manager) to the National Hydrography Dataset (www.nhd.usgs.gov).
- *Processing*—Locations of vandalism were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.

- *Cautions*—The polygon dataset does not convey specific locations of poaching or poaching frequency. The NAD83 datum was assumed for the geographic coordinates in the original table. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Weighting

The assigned weight (on a scale of 1 to 10) and the corresponding rationale for each measure under the untrammeled quality are described in table 2.

Table 2—Measure weights and rationales for the untrammeled quality.

Indicator	Measure	Weight	Rationale
Actions authorized by the Federal land manager that manipulate the biophysical environment	Suppressed fires	10	Highest weight because wildfire suppression in the SNF has been occurring for over a century and has had a significant effect on wilderness ecosystems.
	Fish stocking	8	High weight because fish have been stocked throughout the area that is now the wilderness for at least 80 years.
	Prescribed fires	8	High weight because prescribed burning is widespread in the wilderness.
	Fish surveys	5	Medium weight because surveying entails numerous manipulative actions.
	Non-native plant treatments	2	Low weight because the extent of non-native plants is mainly limited to disturbed areas and treatments are generally restricted to manual removal.
	Dam water level manipulation	1	Lowest weight because only a limited number of dams are still active and functioning.
	Animal manipulation	1	Lowest weight because agency animal captures occur relatively infrequently and only in a few locations for the purposes of habitat manipulation and research.
	Soil disturbance	1	Lowest weight because there are few locations where significant soil disturbance has taken place relative to the size of the wilderness.
	Fish spawn collection	1	Lowest weight because spawn are only collected from two lakes.
Actions not authorized by the Federal land manager that manipulate the biophysical environment	Vandalism of natural resources	2	Low weight because there are few locations of unauthorized vandalism relative to the size of the wilderness.
	Poaching	1	Lowest weight because citations are likely infrequent relative to the number of actual violations.

Maps

The weighted measures under each indicator were added together using a raster calculator to create two maps: “actions authorized by the Federal land manager that manipulate the biophysical environment” and “actions not authorized by the Federal land manager that manipulate the biophysical environment” (fig. 4). All the measures were then added together using the same process to create the untrammeled quality map (fig. 5).

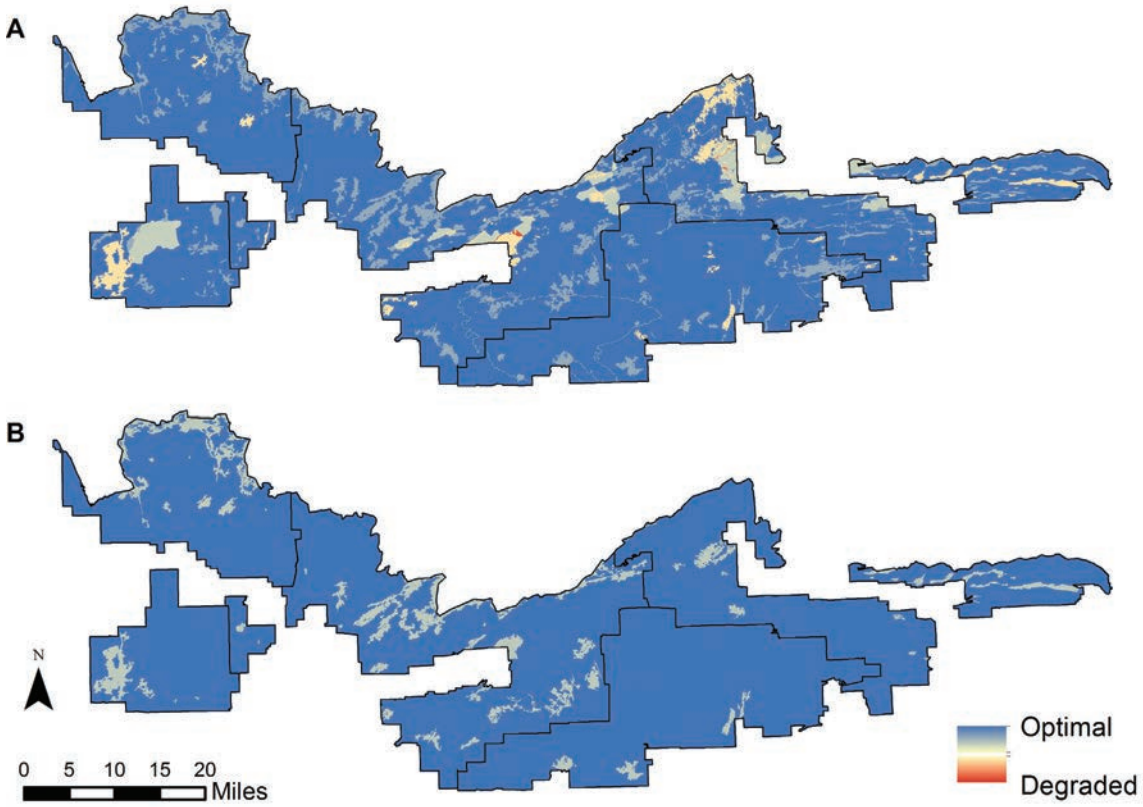

Figure 4—Indicator maps for (A) actions authorized by the Federal land manager that manipulate the biophysical environment and (B) actions not authorized by the Federal land manager that manipulate the biophysical environment. Blue depicts optimal condition and red depicts degraded condition.

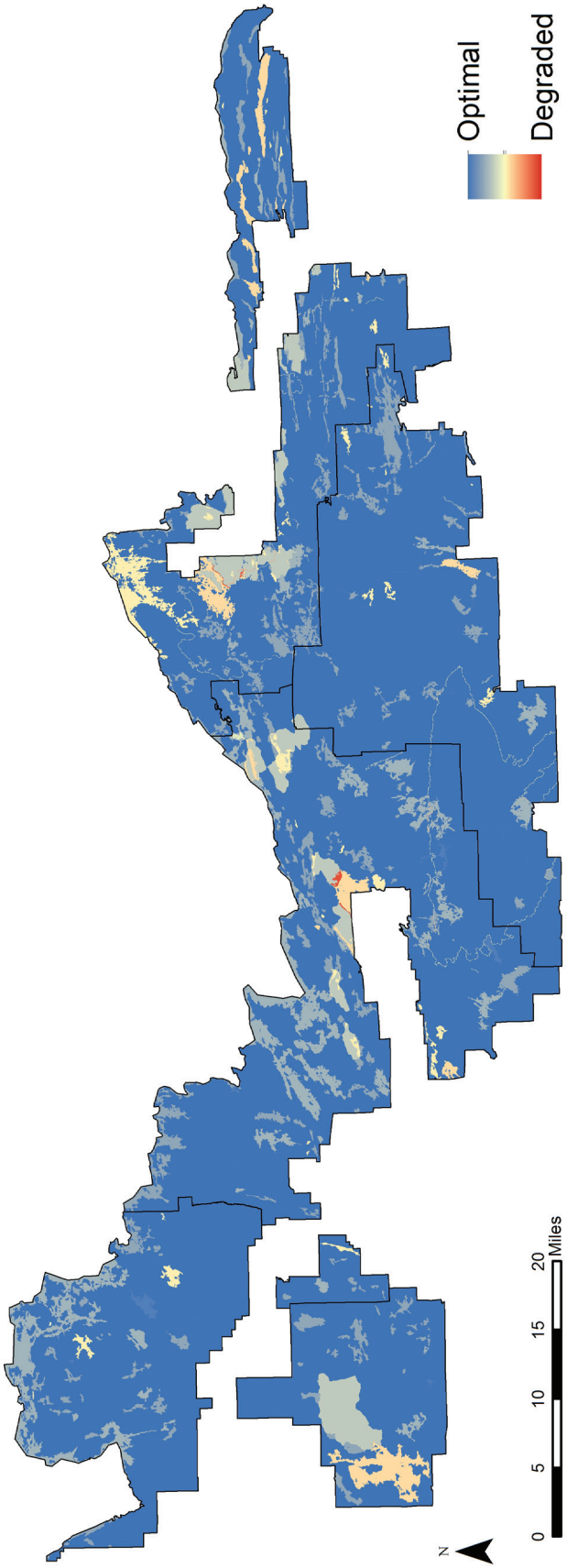

Figure 5—Map of the untrammeled quality of wilderness character. Blue depicts optimal condition and red depicts degraded condition.

Natural Quality

The natural quality centers on the idea that wilderness contains ecological systems that are substantially free from the effects of modern civilization. This quality is degraded by the intended or unintended effects of modern people on ecological systems inside wilderness (Landres and others 2008a, 2015).

Indicators and Measures

Keeping it Wild delineates three indicators under the natural quality[10]. The measures selected for the BWCAW are described below for each of these indicators.

Indicator: Plant and animal species and communities.

- Non-native invasive species—Known locations of plant and animal non-native invasive species (NNIS). NNIS alter the natural environment and displace native species. Vectors for spread include the many types of recreation and travel, fires and accompanying soil disturbance, and intentional species introductions. Current infestation levels of NNIS are relatively low with most terrestrial species restricted to trails, portages, campsites, and other disturbed or burned areas. NNIS in the BWCAW include the spiny water flea (present in 16 lakes), rusty crayfish (29 lakes), earthworms (94 known sites), and various plants (1,604 known locations of purple loosestrife, leafy spurge, spotted knapweed, Canada thistle, tansy, St. John's wort, orange and yellow hawkweed, milfoil, etc.). Fish species stocked before 1964 that have persisted to the present day (including small mouth bass, rainbow trout, and brook trout) are considered "indigenous" and not included in this measure.
- Historical logging activity—Acres of forest that were historically logged. Historical harvest activities have changed the natural structure of the forest; in comparison to old-growth forests, logged forests are often less biologically diverse and have fewer rare, threatened, and endangered species. While no logging has occurred since 1978, 52,290 acres were logged between 1964 and 1978, and 200,632 or more acres were logged prior to 1964.
- Change in biodiversity—Areas with lower levels of biodiversity, as determined by the Minnesota Biological Survey (MBS). The MBS biodiversity assessments are based on landscape functionality as well as the distribution and ecology of rare plants, rare animals, and native plant communities. In the BWCAW, biodiversity is threatened by trails, portages, campsites, historical timber harvest, high intensity fires, NNIS, and climate change. Only two locations were identified as having decreased or moderate levels of biodiversity: Phoebe Wager Site 129 (encompassing the headwaters of the Kawishiwi River, in the Phoebe River watershed) and

[10] *Keeping it Wild* also describes a fourth indicator under the undeveloped quality: loss of statutorily protected cultural resources. This indicator was not included under the undeveloped quality for this mapping project but instead was encompassed by new indicators under the added other features of value quality.

Gunflint Mayhew Site 133 (encompassing portions of the headwaters of the Rainy and Pigeon Rivers, in the Rainy and Lake Superior-North watersheds).

- Extirpated species—The extirpation of caribou across the wilderness. The loss of native species changes the community of life and fundamentally alters natural ecosystems. The extirpation of caribou is used in this measure to represent all extirpations of native species from the BWCAW. Caribou were once common across northern Minnesota, but widespread habitat and food-source loss, as well as increased hunting pressure, resulted in their extirpation in the 1930s. While there have been occasional caribou sightings in the subsequent years, no permanent population has reestablished itself. At this time the State is not considering caribou reintroduction, nor is the SNF considering caribou habitat restoration.
- Habituated bears—Locations that are known to have frequent problems with habituated bears. Bears that are habituated to humans may raid camps or packs for food, or even harass or attack visitors. These behaviors are unnatural, threaten human safety, and may result in lethal bear dispatch. Sixty-four campsites, portages, and trails were identified as being commonly frequented by habituated bears.

Indicator: Physical Resources.

- Recreation-related soil loss—Sites with more than 800 square feet of exposed mineral soil. Exposed soil is more likely to erode or become compacted, which consequently results in decreased soil productivity and loss of vegetation. Soil exposure in the BWCAW is most commonly associated with high levels of recreational use and accompanying maintenance efforts. Out of more than 1,957 total designated campsites, 291 exceed SNF plan standards for the area of disturbed soil.
- Nitrogen deposition—The extent of nitrogen deposition in the wilderness. Nitrogen is a major component of acidic deposition (acid rain) and can cause chemical changes in soil and water that significantly impact nutrient cycling, vegetation growth, and the abundance or survival of aquatic insects and fish. The primary sources of nitrogen pollution are nitrogen oxides (NO_X), generated from the burning of fossil fuels, and ammonia (NH_3), generated from agricultural activities including livestock management and fertilizer application. Nitrogen oxides and ammonia react with water molecules in the atmosphere and return to earth as nitric acid (HNO_3) and ammonium (NH_4). In the BWCAW, nitrogen deposition artificially fertilizes lakes that are naturally nutrient-poor; this fertilization could cause a shift toward non-native species that would otherwise have been unable to survive. While levels of nitrogen deposition in northeastern Minnesota have remained relatively flat for the past 35 years, the spread of agricultural feedlots in southern Minnesota and Iowa threatens to increase nitrogen deposition in the future.
- Sulfur deposition—The extent of sulfur deposition. Like nitrogen, sulfur is a major component of acidic deposition and can negatively impact aquatic and terrestrial plants and animals by chemically altering soils and surface waters. Sulfur can also facilitate the uptake of mercury into the aquatic food chain. The primary source of sulfur pollution is sulfur dioxide (SO_2), which is generated from the burning of

fossil fuels. Sulfur dioxide combines with water molecules in the atmosphere and returns to earth as sulfuric acid (H_2SO_4). Over the last 35 years, sulfur deposition has decreased in northeastern Minnesota (paralleling a similar decrease in sulfur dioxide emissions both regionally and nationally). It is important to continue monitoring sulfur deposition to ensure these gains are maintained.

- Impounded water—Dammed lakes with unnaturally high water levels. Impounding water can affect water temperature and chemistry, flow regime, channel shape, sediment transport, physical habitats, and the species diversity of algae, macroinvertebrates, fish, and riparian vegetation. Dammed lakes with unnaturally high water levels include: Fall, Gabbro, Little Gabbro, Moose, Newfound, and Sucker.
- Shoreline erosion—Shorelines affected by water releases from dammed lakes. Artificial fluctuations in water levels can result in the loss of shoreline soil, leading to subsequent impacts on plant and animal species. Shoreline degradation from artificial water level fluctuation occurs at only one location in the BWCAW, an island within Fall Lake. The changes in the water levels of Fall Lake originate from a dam outside of the wilderness on Garden Lake.

Indicator: Biophysical Processes.

- Departure from natural fire regimes—The degree of departure from the historical fire regime across the wilderness. Fire regime patterns are fundamental ecosystem processes that play a critical role in determining vegetation composition and structure. Departure from the historical fire regime can cause significant changes in plant and animal communities. Humans have altered natural fire regimes over time through fire suppression, fuel management, timber harvest, etc. For this measure, the percent change between historical and current vegetation conditions was used to determine departure from the historical fire regime; the percent change was then classified as representing high, moderate, and low departure. In the BWCAW, the majority of the wilderness shows moderate departure (between 33 percent and 66 percent) from the historical fire regime.
- Change in winter temperature—The change in the average minimum winter temperature across the wilderness over the last century. Winter temperatures determine lake ice extent and duration, growing season timing, and fish and wildlife reproductive phenology, populations, and range shifts; minimum winter temperatures are particularly important because they can limit species survival. Historically, low minimum winter temperatures in northern Minnesota have restricted the suitable habitat of temperate tree species like red maple and have protected the area from non-native plant and animal species that cannot tolerate harsh winters. This may change in the future as northern Minnesota's climate is already warming and is projected to experience dramatic shifts by the end of the century. For this measure, the change in temperature was determined using statistical analyses of all December–February average minimum temperature data from 1901 to 2011. Across the BWCAW, average minimum winter temperatures have increased by approximately 2 to 6 degrees Fahrenheit over the last 110 years.

- Beaver removal—Lakes where beavers have been removed. Beavers are a key wetland species and their removal can have ecosystem level changes including impacts to vegetation, insects and other invertebrates, and fish and wildlife. Only seven lakes in the BWCAW have had beavers removed by the Minnesota Department of Natural Resources (Minnesota DNR).

Data Gap Measures

Additional measures under this quality were identified by SNF staff but were excluded for a variety of reasons. For each data gap measure, the indicator, description, and rationale for their dismissal are listed below.

Timber plantations

- *Indicator*—Plant and animal species and communities.
- *Description*—Many timber units in wilderness were planted with a single tree species after harvest, which led to the cultivation of plantation-like monocultures. These plantations alter vegetation communities, increase homogenization and fragmentation, and directly reduce biodiversity. By transforming large areas of forest from one habitat type to another, plantations may also promote species extinctions. Planting a monoculture after first opening the forest canopy through timber harvesting can increase forest temperature and alter fire patterns and behavior as well.
- *Rationale for dismissal*—Although there are various digital maps for referral (e.g., Heinselman and USGS 2014), as well as some physical SNF maps (e.g., for harvests between 1964 and 1978), data were incomplete. Most maps were not digitized and would have taken considerable time to prepare; they also would have required making too many assumptions and would have led to unacceptable levels of unreliability. The Heinselman maps also lacked information on the type of disturbance (fire vs. timber harvest) and the method of reestablishment (natural succession vs. planting).

Land cover change

- *Indicator*—Plant and animal species and communities.
- *Description*—Timber harvest and other human manipulation in wilderness have caused changes in the natural land cover, which have altered plant communities and patterns of wildlife movement. In the BWCAW, certain boreal plant and animal species are presumed to be losing dominance as a result of land cover change.
- *Rationale for dismissal*—This measure was considered based on the assumption that timber harvest, post-harvest planting, fire suppression, and other manipulation had resulted in decreased jack pine cover in the wilderness. Upon examination, however, it was determined that jack pine cover has actually increased relative to historical data and assumptions. The effect of land cover change on plant communities was therefore less evident than originally believed. In addition, data on changes in wildlife movement patterns as a result of land cover change do not currently exist.

Non-native insects and pathogens

- *Indicator*—Plant and animal species and communities.
- *Description*—Repeated invasions of non-native insects and pathogens have altered the structure and function of forest ecosystems. Short-term disturbances associated with these pests include reduced productivity, tree decline and mortality, disruption of nutrient cycles, and decreased seed production. Longer-term impacts include shifts in tree species composition that alter productivity, nutrient cycling, and biodiversity. Known insect and disease NNIS threats to the boreal forests of the BWCAW include gypsy moth, emerald ash borer, and white pine blister rust. Unsubstantiated reports of viral hemorrhagic septicemia, larch case bearer, and Dutch elm disease have also been recorded for the wilderness.
- *Rationale for dismissal*—While data were available for the wilderness, they were too large scale to be useful. Most maps showed northeastern Minnesota as the general location of infestation, without any further specificity. Some State and county maps had slightly more detail but were still not sufficient for pinpointing infestation locations inside the wilderness.

Water quality

- *Indicator*—Physical resources.
- *Description*—Water quality is of critical importance in the lake-based ecosystems of the BWCAW. Several lakes have had problems with latrine overflow and runoff after heavy rains; in other lakes, loon and fish testing has also revealed unnatural mercury levels. Untreated sewage from latrines can contain more than 120 viruses, including giardia and cryptosporidium, which can cause intestinal illnesses and even death. Lake contamination with mercury—highly potent neurotoxin that impacts the function and development of the central nervous system—can have serious impacts on both people and wildlife.
- *Rationale for dismissal*—Although historical water sampling data are believed to exist, it would have taken considerable time to digitize the data once they were located. Data on mercury concentrations in fish are available for certain sampled lakes but cannot be extrapolated to neighboring non-sampled lakes due to watershed properties controlling mercury cycling. The Minnesota Pollution Control Agency completed representative sampling for latrine runoff in 2014 and 2015, and has plans for continued sampling; these data could potentially be used in future iterations of the map.

Climate change impacts

- *Indicator*—Biophysical processes.
- *Description*—Climate change has already begun to change biophysical processes in the BWCAW. Impacts from climate change include changes to insect and pathogen regimes, precipitation patterns, snow depth, and plant and animal phenology.
- *Rationale for dismissal*—Available data were inappropriate for the scale of the wilderness. Maps for precipitation and snow depth—from RAWS (Remote Automated Weather Stations) data and SNOTEL (Snow Telemetry) data, respectively—were not specific enough for the wilderness. Available plant and animal phenology maps—using MODIS (moderate resolution spectroradiometer) data—could not be used to determine local degradation.

Loss of connectivity

- *Indicator*—Biophysical processes.
- *Description*—Loss of connectivity disrupts ecological process including the movement of wildlife and fire across the landscape. Connectivity in the BWCAW is impacted by dams, timber sale areas, inholdings, separated units (i.e., the Trout Lake and Vento units) and cherry-stem roads (including the Fernberg Road and the Echo, Sawbill, Gunflint, and Arrowhead Trails).
- *Rationale for dismissal*—Data on wildlife movement patterns do not currently exist. Other possible data sources would have required making too many assumptions and were therefore rejected.

Data Sources, Processing, and Cautions

A wide variety of datasets were used to create the natural quality map. These datasets included both vector and raster data, exhibited high variation in scale, had mostly high levels of accuracy, and had differing levels of completeness (table 3). The data sources, data processing information, and cautions are listed below for each measure.

Table 3—Natural quality datasets. Accuracy (how well the dataset represents the measure) and completeness (how complete the dataset is across the wilderness) were evaluated for each measure by SNF staff familiar with these data.

Measure	Source	Type	Scale	Accuracy	Completeness
Non-native invasive species	(1) NNIS_AquaticBWCAW.shp; (2) WeedPointsBWCAW2009_2013.shp; (3) BWCAW_WormsPT.shp; (4) BWCAW_WormsLN.shp	Point and Polyline	1:24,000	High	Low to Medium
Historical logging activity	(1) HeinselmanHarvests_Pre1964.shp; (2) Post1964Harvesting.shp	Polygon	1:126,720; 1:24,000	Medium to High	Medium
Change in biodiversity	ModerateBioSignificance.shp	Polygon	1:24,000	High	Medium
Extirpated species	BWCAW_Boundary.shp	Polygon	1:24,000	High	High
Habituated bears	HabituatedBears.shp	Point	1:63,360	Medium	High
Recreation-related soil loss	ExposedSoil.shp	Point	1:63,360	Medium	High
Nitrogen deposition	n_td_mean	Raster	4134m	High	Medium
Sulfur deposition	s_td_mean	Raster	4134m	High	Medium
Impounded water	ImpoundedWater.shp	Polygon	1:24,000	High	High
Shoreline erosion	BWCAW_NHD_Waterbody	Point and Polygon	1:24,000	High	High
Departure from natural fire regimes	VCC_BWCAW	Raster	30m	Medium	High
Change in winter temperature	T1nw0111mnd	Raster	4094m	High	High
Beaver removal	BWCAW_NHD_Waterbody	Polygon	1:24,000	High	High

Non-native invasive species

- *Sources*—(1) Point dataset of survey locations indicating the presence of earthworms (Heather Jenson, SNF Monitoring Crew Leader, and Dan Wovcha, Minnesota DNR Plant Ecologist); (2) point dataset of non-native plant locations

from 2009 to 2013 (Jack Greenlee, SNF Plant Ecologist); (3) polyline dataset of transects with the presence of earthworms (David Chaffin, University of Minnesota Ph.D. Student); (4) polygon dataset of lakes containing spiny water flea and/or rusty crayfish, created by relating aquatic NNIS monitoring data (Jason Butcher, SNF Fisheries Ecologist) to the National Hydrography Dataset (www.nhd.usgs.gov).

- *Processing*—Locations of all NNIS were assigned a value of 1. Layers were converted to individual rasters and added accumulatively. Values were then normalized to 0–255.
- *Cautions:* The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Historical logging activity

- *Sources*—(1) Polygon dataset of stand origin, logging history, and burn areas, digitized from maps annotated by Heinselman and others (2014); (2) polygon dataset of timber sales, digitized from the "BWCA Timber Rehabilitation Report," May 15, 1980 (USDA Forest Service 1980).
- *Processing*—Locations of all timber harvests were assigned a value of 1. Layers were converted to individual rasters and combined together. Overlapping cells were re-classed back to a value of 1, after which values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Change in biodiversity

- *Sources*—Polygon dataset of areas with unnatural ecological changes rated as having moderate biodiversity (Chel Anderson and Lawson Gerdes, Minnesota DNR Plant Ecologists).
- *Processing*—Sites of biodiversity change were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Extirpated species

- *Sources*—Polygon dataset of the BWCAW representing the extirpation of caribou from the entire wilderness (Susan Catton, SNF Wildlife Biologist).
- *Processing*—The entire wilderness was assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—N/A.

Habituated bears

- *Sources*—Point dataset of campsites that are frequented by bears habituated to humans, created by relating institutional knowledge of known problem areas (SNF District Wilderness Staff) to the BWCAW campsite dataset.

- *Processing*—Campsites were buffered by 100 meters and assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Recreation-related soil loss

- *Sources*—Point dataset of campsites that contain more than 800 square feet of exposed mineral soil, created by relating institutional knowledge of known areas (SNF District Wilderness Staff) to the BWCAW campsite dataset.
- *Processing*—Campsites were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Nitrogen deposition

- *Sources*—Raster datasets of nitrogen deposition for the individual years 2007–2012, developed by the Community Multiscale Air Quality (CMAQ) modeling system (Byun and Schere 2006). The datasets were obtained from the Environmental Protection Agency (EPA)-Clean Air Status and Trends Network (CASTNET) ftp server (ftp://ftp.epa.gov/castnet/tdep; download date 10/28/2014).
- *Processing*—The national extent data were clipped to the extent of the BWCAW boundary and a new raster was created to represent the mean of the six input years. The average nitrogen grids were re-projected from Albers to UTM using the bilinear method. Null values along the international border were replaced with a value of 0, and all values were normalized to 0–255.
- *Cautions*—Due to the resolution of these datasets, there are missing values along the international border. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Sulfur deposition

- *Sources*—Raster datasets of sulfur deposition for the individual years 2007–2012, developed by the CMAQ modeling system (Byun and Schere 2006). The datasets were obtained from the EPA-CASTNET ftp server (ftp://ftp.epa.gov/castnet/tdep; download date 10/28/2014).
- *Processing*—The national extent data were clipped to the extent of the BWCAW boundary and a new raster was created to represent the mean of the six input years. The average sulfur grids were re-projected from Albers to UTM using the bilinear method. Null values along the international border were replaced with a value of 0, and all values were normalized to 0–255.
- *Cautions*—Due to the resolution of these datasets, there are missing values along the international border. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Impounded water

- *Sources*—Polygon dataset of lakes that have increased water levels due to the presence of dams, created by relating institutional knowledge of dammed lakes (Marty Rye, SNF hydrologist) to the National Hydrography Dataset (www.nhd.usgs.gov).
- *Processing*—All impounded waters were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Shoreline erosion

- *Sources*—Polygon dataset of lakes affected by dams, created by relating institutional knowledge of dammed lakes (Marty Rye, SNF hydrologist) to the National Hydrography Dataset (www.nhd.usgs.gov).
- *Processing*—The affected island polygon was selected within the dammed lake, converted to a polyline, and assigned a value of 1. The new layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Departure from natural fire regimes

- *Sources*—Raster dataset of vegetation condition class representing the degree of departure from the historical fire regime, developed by LANDFIRE (www.landfire.gov).
- *Processing*—The dataset was re-projected and clipped to the BWCAW boundary. Using the "Description" field, low vegetation departure was assigned a value of 1, moderate vegetation departure was assigned a value of 2, and high vegetation departure was assigned a value of 3. Values were then normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Change in winter temperature

- *Sources*—Raster dataset of the change in average daily minimum winter (December–February) temperatures from 1901 to 2011, developed for the Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis Report (Stephen Handler, Forest Service Northern Research Station Climate Change Specialist; Handler and others 2014). The original data were derived from PRISM (Parameter-elevation Regressions on Independent Slopes Model) (Gibson and others 2002), which models historical measured point data onto a continuous 2.5-mile grid for the entire United States.

- *Processing*—The dataset was re-projected and clipped to the BWCAW boundary. Values were then normalized to 0–255.
- *Cautions*—Distinguishing whether local ecological changes are due to anthropogenic climate change or to natural variation can be difficult, and the threshold at which a change in temperature represents a degradation to wilderness character is unknown. For this measure, therefore, any increase in temperature was interpreted as negatively impacting the natural quality. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Beaver removal

- *Sources*—Polygon dataset of lakes where beavers are trapped, created by relating beaver trapping records (Dawn Plattner, Minnesota DNR Assistant Wildlife Supervisor) to the National Hydrography Dataset (www.nhd.usgs.gov).
- *Processing*—Lakes where beavers are trapped were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Weighting

The assigned weight (on a scale of 1 to 10) and the corresponding rationale for each measure under the natural quality are described in table 4.

Table 4—Measure weights and rationales for the natural quality.

Indicator	Measure	Weight	Rationale
Plant and animal species and communities	Non-native invasive species	6	Medium weight because this measure is of high management concern given the amount of visitation and the number of possible vectors for spread.
	Historical logging activity	3	Low weight because the data from 1964 to 1978 are considered incomplete. Many of the harvest maps from this period were discarded after the BWCAW legislation was enacted.
	Change in biodiversity	2	Low weight because not all areas have been surveyed, and of those that have, only two locations were determined to be less than natural. The weight may change in the future if more areas are surveyed and determined to have low or moderate biodiversity.
	Extirpated species	2	Low weight because it is considered unlikely that caribou will naturally reestablish or be reintroduced in the near future.
	Habituated bears	1	Lowest weight because there are few problem sites relative to the entirety of the BWCAW.

Indicator	Measure	Weight	Rationale
Physical resources	Recreation-related soil loss	6	Medium weight because a significant number of sites are threatened by extensive soil exposure.
	Nitrogen deposition	5	Medium weight because the wilderness is a Class 1 Airshed and nitrogen deposition is above natural levels.
	Sulfur deposition	5	Medium weight because the wilderness is a Class 1 Airshed and sulfur deposition is above natural levels.
	Impounded water	2	Low weight because dammed lakes have caused increased water levels for only a small number of lakes.
	Shoreline erosion	1	Lowest weight because shoreline degradation from water level fluctuation occurs at only one location.
Biophysical processes	Departure from natural fire regimes	8	High weight because the effects of historical and contemporary fire suppression—such as blowdowns, fuel build-up, and changes in the dominant tree species—are significant.
	Change in winter temperature	2	Low weight because it is difficult to anticipate how climate-related impacts may influence management in wilderness. The weight may change in the future as more information becomes available.
	Beaver removal	2	Low weight because beaver removal is limited and is becoming more infrequent.

Maps

The weighted measures under each indicator were added together using a raster calculator to create three maps: “plant and animal species and communities,” “physical resources,” and “biophysical processes” (fig. 6). All the measures were then added together using the same process to create the natural quality map (fig. 7).

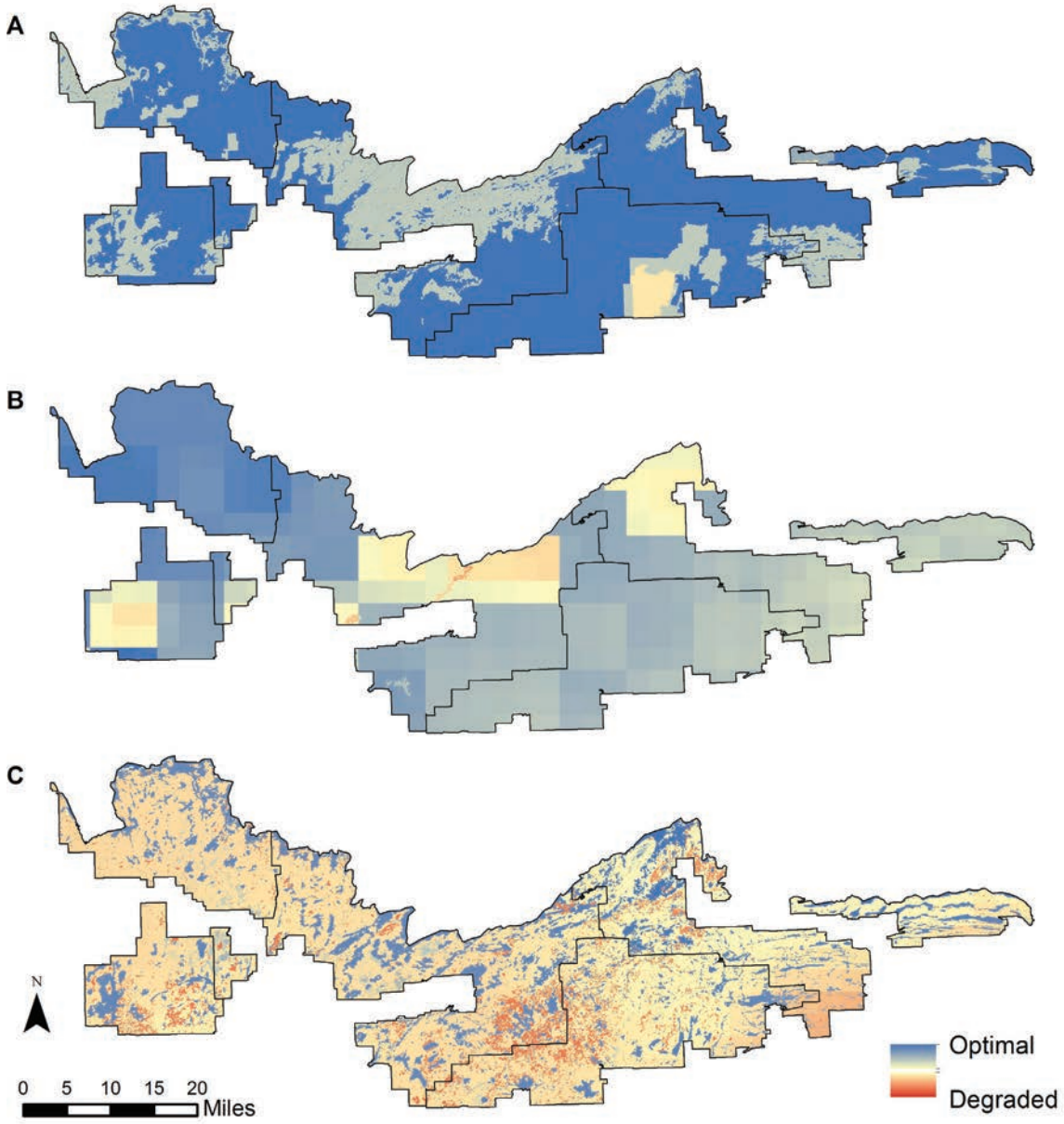

Figure 6—Indicator maps for (A) plant and animal species and communities, (B) physical resources, and (C) biophysical processes. Blue depicts optimal condition and red depicts degraded condition.

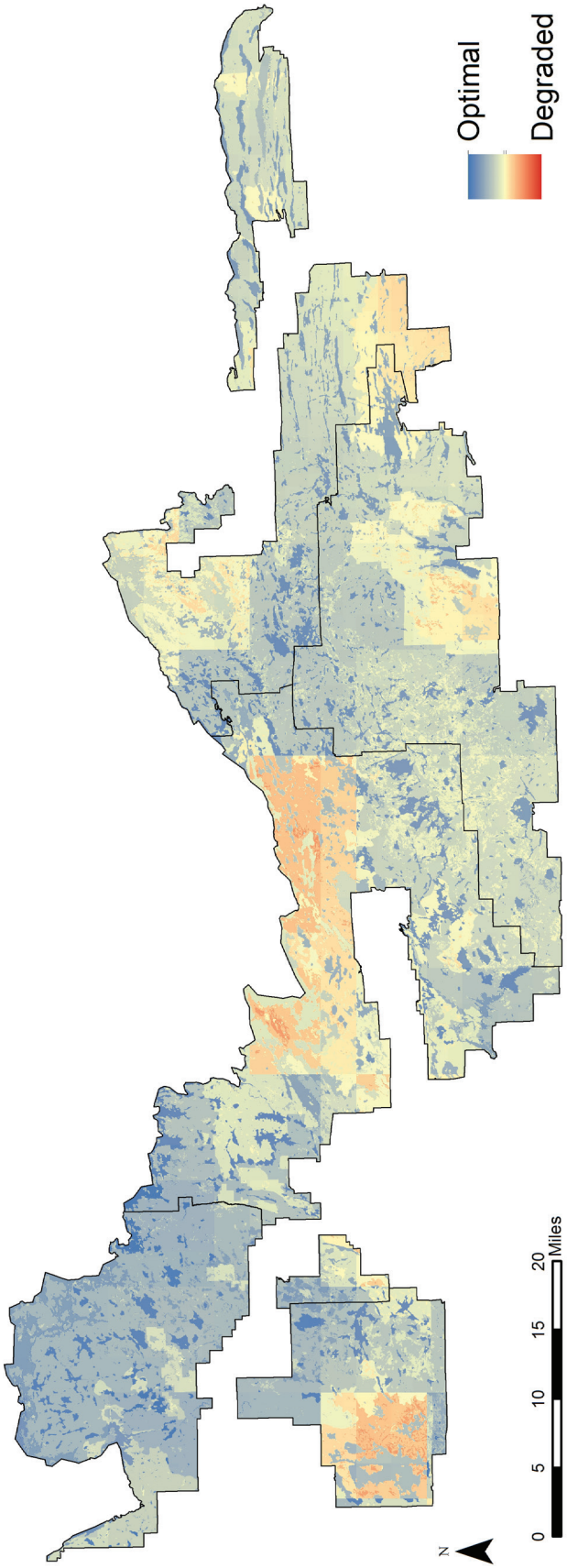

Figure 7—Map of the natural quality of wilderness character. Blue depicts optimal condition and red depicts degraded condition.

Undeveloped Quality

The undeveloped quality centers on the idea that wilderness is without permanent improvements or modern human occupation. This quality is degraded by the presence of structures and installations, as well as the use of motor vehicles, motorized equipment, and mechanical transport, because these increase people's ability to occupy or modify the environment (Landres and others 2008a, 2015).

Indicators and Measures

Keeping it Wild delineates three indicators under the undeveloped quality. The measures selected for the BWCAW are described below for each of these indicators. No data gap measures were identified for this quality.

Indicator: Non-recreational structures, installations, and developments.

- Authorized developments—Locations of authorized non-recreational physical developments. The Wilderness Act defines wilderness as an area without permanent improvements, which include authorized developments. For this measure, developments were ranked based on their areal footprint, size, or noticeability: buildings and structures were depicted as having a large impact, docks and functioning dams as having a moderate impact, and markers or non-functioning dams as having a small impact. Out of 472 authorized non-recreational developments in the wilderness, there are 7 administrative cabins and 2 outhouses, 31 historical dams, 12 docks, 419 border reference markers, and 1 plaque (marking the highest State point).
- Research installations—Locations of authorized research installations. Although research installations are often unnoticeable, they are still developments indicative of modern human modification of the wilderness. In contrast to other management areas of National Forests, in wilderness there is higher scrutiny for approving scientific activities and any associated installations. The BWCAW has relatively few scientific developments: a water gauge in Jack Fish Bay and USGS wolf traps and trap lines.

Indicator: Inholdings.

- Developed inholdings—Locations of physical developments on inholdings inside wilderness. Inholdings are not held to the same regulations as wilderness lands and therefore face a higher threat of development. As private land is considered more likely to be developed than public land owned by the State or county, installations on these inholdings were depicted as having a larger impact. There are 21 developments on wilderness inholdings.
- Infrastructure supporting inholdings—Locations of infrastructure supporting private inholdings. Infrastructure that connects inholdings to the power grid is an obvious sign of modern human habitation in wilderness. In the BWCAW, there are two areas where inholdings are supported with this type of development: Saganaga Lake and Sandpoint Lake. The Saganaga Lake infrastructure includes a road as well as powerlines and supports several privately developed inholdings.

Powerlines adjacent to Sandpoint Lake are located on a State inholding and support private cabins north of the wilderness. While the infrastructure on Saganaga Lake is regularly used and conspicuous, that on Sandpoint Lake is not on travel routes and is substantially unnoticeable.

- Undeveloped inholdings—Areas of undeveloped inholdings in the wilderness. Undeveloped inholdings still pose a risk of development in the future as they are not restricted by Federal laws and policies. These inholdings are generally indistinguishable from wilderness lands and are considered a high priority for acquisition by the Forest Service. For this measure, State and county inholdings were depicted as having a smaller potential impact than private inholdings since they are presumed to be at lower risk for future development. There are approximately 111,230 acres of undeveloped inholdings within the wilderness that are owned by the State (105,926 acres), county (4,863 acres), and private entities (441 acres).

Indicator: Use of motor vehicles, motorized equipment, or mechanical transport.

- Legal motorized/mechanized use—Areas where motorized use or mechanized travel is legally permitted. Although certain exceptions for motorized equipment and mechanized travel are legally allowed in the BWCAW through special provisions in both the Wilderness Act (1964) and the Boundary Waters Canoe Area Wilderness Act (1978), these uses are generally prohibited in wilderness areas (as described in Section 4[c] of the Wilderness Act of 1964). Motorized use is generally considered to have a greater impact on the undeveloped quality than mechanized transport and is depicted as such for this measure. Trails, portages, and lakes that permit these nonconforming uses are contained within the semi-primitive motorized management area. This area encompasses 6 routes allowing the use of portage wheels, 4 portages allowing rail-car or motorized transport, and 2 trails allowing snowmobiles; it also includes 20 lakes and rivers allowing motorized use, of which 5 have a 10 horsepower (hp) limit, 11 have a 25 hp limit, and 4 have no hp restrictions.

- Administrative motorized/mechanized use—Areas where motorized use or mechanized travel is authorized for administrative agency use. Motorized use and mechanized transport are generally prohibited by the Wilderness Act, but exceptions are allowed when necessary to meet the minimum requirements for administration of the wilderness and when permitted through legislated special provisions. Minimum requirements analyses are conducted by SNF staff for proposed administrative use of motorized equipment or mechanized transport in all non-motorized management areas. The Forest Service, USGS, Border Patrol, and Minnesota DNR regularly use towboats, motorboats, fixed-wing aircraft, float planes, helicopters, and snowmobiles for administrative purposes in the BWCAW. Administrative motorized use by the SNF consists of ski trail grooming with a snowmobile (14.5 miles groomed annually by a partner organization) and fire detection flights (104 miles flown on average each year). Other administrative motorized use includes USGS aerial wolf surveys (55 miles flown from 2012 to 2014), Border Patrol flights (150 miles along the international boundary), and Minnesota DNR activities including fish stocking (72 lakes stocked using

motorized access from 1988 to 2013), fish surveys (80 lakes surveyed using motorized access from 1978 to 2013), spawn collection (2 lakes harvested using motorized access between 1980 and 2013), and aerial moose surveys (294,693 acres surveyed from 2013 to 2014).

- Emergency motorized/mechanized use—Locations where motorized equipment or mechanized transport were used for emergency purposes. While motorized equipment and mechanized transport are permitted in wilderness if necessary to protect human life and safety, they are still considered nonconforming uses. Motorized equipment used during an emergency can include chainsaws, water pumps, generators, helicopters, fixed-wing aircraft, float planes, drones, motorboats, off-highway vehicles (OHVs), and snowmobiles. The SNF consults a pre-emergency authorization matrix and conducts after-action reviews to reduce unnecessary emergency authorizations for nonconforming uses. From 2001 to 2013, motorized use and/or mechanized transport were authorized for law enforcement activities (on 9 lakes and 1 river), search and rescue operations (on 63 lakes, 2 rivers, and 7 trails), wildfire suppression events (84 wildfires), and prescribed burns (9 fires).
- Unauthorized motorized/mechanized use—Locations where unauthorized and illegal motorized use or mechanical transport occurred. Unauthorized nonconforming uses are prohibited by the Wilderness Act. This measure encompasses illegal nonconforming uses that are not permitted by special provisions in the Wilderness Act or subsequent BWCAW legislation. Illegal motorized use or mechanized transport in the BWCAW includes the use of OHVs, snowmobiles, motorboats, tow boats, float planes, ski kites, and canoe sails. From 2009 to 2013, there were 351 violation notices written for unauthorized incidents of nonconforming use.

Data Sources, Processing, and Cautions

The datasets used to create the undeveloped quality map are all vector data, of fine scale, and generally of moderate to high accuracy and completeness (table 5). The data sources, data processing information, and cautions are listed below for each measure.

Table 5—Undeveloped quality datasets. Accuracy (how well the dataset represents the measure) and completeness (how complete the dataset is across the wilderness) were evaluated for each measure by SNF staff familiar with these data.

Measure	Source	Type	Scale	Accuracy	Completeness
Authorized developments	AuthorizedPhysicalDevlopment	Point	1:24,000	Low - Medium	Medium - High
Research installations	(1) WolfTrapPortageMidPoint; (2) USGS_GagingStation	Point	1:70,000; 1:24,000	High; Low	High
Developed inholdings	StructureNonFS	Point	1:63,360	High	High
Infrastructure supporting inholdings	InholdingSupportFeature	Polyline	1:20,000	High	High
Undeveloped inholdings	BWCAW_Inholdings	Polygon	1:24,000	High	High
Legal motorized/ mechanized use	(1) SemiPrimitiveMotorRoute; (2) SemiPrimitiveMotorUseLake	Polyline and Polygon	1:24,000	High	High

Measure	Source	Type	Scale	Accuracy	Completeness
Administrative motorized/ mechanized use	(1) FireDetectionRoute_LN; (2) MooseHelicopterSurveyAreas2013_14; (3) WolfSurveyFlight_LN; (4) international_bdny; (5) ski_trail; (6) BWCAW_StockedLakes1988_201; (7) BWCAW_SpawnTake; (8) BWCAW_DNR_MotorSurveyLks1978_2013	Polyline and Polygon	1:40,000	High	High
Emergency motorized/ mechanized use	(1) NonRecMotorUse; (2) NonRecMotorUse_LN	Polyline and Polygon	1:24,000	Medium	High
Unauthorized motorized/ mechanized use	(1) UnauthMotorUseFromLEO_Report; (2) anderson	Point and Polyline	1:40,000	Low	Low

Authorized developments

- *Sources*—Point dataset of authorized developments, derived from SNF INFRA data, International Boundary Commission data, and institutional knowledge (SNF District Wilderness Staff).
- *Processing*—The various types of authorized developments were ranked with the following values by the project core team to depict the differences in their areal footprint, size, or noticeability:
  - 1 = Eagle Mountain plaque, small non-functioning dams, and border reference markers
  - 2 = Larger, still functioning dams and docks
  - 3 = Cabins and outhouses

  The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Research installations

- *Sources*—(1) point dataset of wolf trap line locations (Shannon Berber-Meyer, USGS Wildlife Biologist); (2) point dataset of gauging station.
- *Processing*—All research installation locations were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—Radio collars used to monitor wildlife are considered mobile research installations but were not included in this measure as data were unavailable. Wolf trap line points represent approximate locations based on descriptions of the trap line routes provided by the USGS (e.g., “the traps were placed about halfway along the portages”). The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Developed inholdings

- *Sources*—Point dataset of developed inholdings (SNF District Wilderness Staff).
- *Processing*—The two types of developed inholdings were ranked with the following values by the project core team to depict the differences in their likelihood of future development:
  - 1 = State land
  - 5 = Private land
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Infrastructure supporting inholdings

- *Sources*—Polyline dataset of infrastructure supporting inholdings (SNF District Wilderness Staff).
- *Processing*—The location of the infrastructure was assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Undeveloped inholdings

- *Sources*—Polygon dataset of undeveloped inholdings, derived from information on State-owned fee interests (Minnesota DNR land records system), private inholdings (Liz Schleif, SNF Realty Specialist), and county managed lands (St. Louis County and Cook County databases).
- *Processing*—The two types of developed inholdings were ranked with the following values by the project core team to depict the differences in their likelihood of future development:
  - 1 = State land
  - 5 = Private land
- *Cautions*—Ongoing land exchange projects (through which the Forest Service will acquire State and county lands within the BWCAW) are not included in this measure. Since county managed lands are actually "State tax forfeited lands" and therefore technically owned by the State, there was some overlap in the State and county input feature classes. In populating the "Inholding" column, where the county and State features overlapped, polygons were listed with the county label. Since the State and county features are from different original sources and spatially are not perfectly coincident, there are portions of "State" land adjacent to "State Tax Forfeited-County" land that represent the same parcel. Therefore, the "BWCAW_Inholdings" shapefile overrepresents the actual area of inholdings. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Legal motorized/mechanized use

- *Sources*—(1) Polyline dataset of semi-primitive motorized/mechanized routes, created by relating institutional knowledge (SNF District Wilderness Staff) to the SNF trail feature class; (2) polygon dataset of BWCAW lakes where motorized

transportation is authorized, derived from the National Hydrography Dataset (www.nhd.usgs.gov).

- *Processing*—The various types of motorized/mechanized routes were ranked with the following values by the project core team to depict the differences in their degree of motorized use:
  - 1 = Trails that only allow the use of portage wheels (mechanized transport of gear)
  - 5 = Trails that allow use of a vehicle or rail car to transport water craft (motorized transport of gear)
  - 10 = Snowmobile trails (motorized transport of humans)

  Lakes with various motor hp restrictions were ranked with the following values by the project core team to depict the differences in their degree of motorized use:
  - 3 = 10 hp
  - 5 = 25 hp
  - 10 = Unlimited (no hp restrictions)

  Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—Motorized ice augers are occasionally used for subsistence ice fishing (as permitted under the Treaty with the Chippewa 1854 Treaty Authority) but were not included in this measure as data were unavailable. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Administrative motorized/mechanized use

- *Sources*—(1) Polyline dataset of fire detection routes (Chippewa and Superior National Forest Dispatch); (2) polygon dataset of moose surveys (Tom Rusch, Minnesota DNR Wildlife Supervisor); (3) polyline dataset of wolf survey flights (Chippewa and Superior National Forest Dispatch); (4) polyline dataset of international boundary patrols (SNF District Wilderness Staff and SNF Law Enforcement); (5) polyline dataset of groomed ski trails (SNF District Wilderness Staff); (6) polygon dataset of lakes stocked with fish, created by relating fish stocking records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov); (7) polygon dataset of lakes where fish spawn collection occurred, created by relating spawn collection records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov); (8) polygon dataset of fish surveys using motorized access, created by relating information on fish survey methodologies (2015 SNF and Minnesota DNR Memorandum of Understanding on fisheries management within the BWCAW) and fisheries records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov).
- *Processing*—All instances of motorized/mechanized use were assigned a value of 1. Layers were converted to individual rasters and added accumulatively. Values were then normalized to 0–255.
- *Cautions*—The polyline of the international boundary does not represent the specific locations or frequency of actual Border Patrol motorized/mechanized use.

Border Patrol does not release their data on nonconforming wilderness uses to the SNF; the SNF will continue to work with the Department of Homeland Security (DHS) to try to obtain this information in a way that meets national security needs. Similarly, the polygon dataset of fish survey locations using motorized access is most likely an underrepresentation of the actual impact. Data indicating whether or not fish surveys used motorized access were unavailable for small, non-remote lakes (i.e., lakes smaller than 450 acres that are accessible by (1) four portages or fewer that are cumulatively less than a mile in distance, (2) less than 15 miles of motorized water travel, or (3) less than 5 miles of non-motorized water travel); however, it is considered possible that fish surveys on these lakes used motorized access. The polygon dataset of moose survey plots does not reflect the actual amount of motorized use as data on the specific flight paths used for both accessing plots and conducting surveys were unavailable. Additionally, data on annual bald eagle nest detection flights and data on occasional U.S. Coast Guard motorized/mechanized use in wilderness were unavailable at the time of mapping. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Emergency motorized/mechanized use

- *Sources*—(1) Polygon dataset of motorized use for law enforcement (Trish Beaudry, SNF Law Enforcement Program Assistant), prescribed fires, fire suppression, and search and rescue; (2) polyline dataset of motorized use for law enforcement (Trish Beaudry, SNF Law Enforcement Program Assistant), prescribed fires, fire suppression, and search and rescue.
- *Processing*—All emergency use locations were assigned a value of 1. Layers were converted to individual rasters and combined together. Overlapping cells were reclassed back to a value of 1, after which values were normalized to 0–255.
- *Cautions*—Emergency motorized use authorized after blowdown events in 1999 and 2014 occurred outside of the timespan used for this measure (2001–2013) and were therefore not included. The circular polygons representing small fires depict the acreage of the fires, but not necessarily the location; the point feature class used as the original source represents the origin of the fire. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Unauthorized motorized/mechanized use

- *Sources*—(1) Point dataset of unauthorized motorized/mechanized use in wilderness (Trish Beaudry, SNF Law Enforcement Program Assistant; Bruce Anderson, Minnesota DNR Assistant Wildlife Manager); (2) polyline dataset of unpermitted commercial tow route.
- *Processing*—Locations of unauthorized/illegal use were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—The NAD83 datum was assumed for the geographic coordinates in the original table. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Weighting

The assigned weight (on a scale of 1 to 10) and the corresponding rationale for each measure under the undeveloped quality are described in table 6.

Table 6—Measure weights and rationales for the undeveloped quality.

Indicator	Measure	Weight	Rationale
Non-recreational structures, installations, and developments	Authorized developments	3	Low weight because non-recreational developments are generally difficult to notice.
	Research installations	1	Lowest weight because there are few research installations in the wilderness.
Inholdings	Developed inholdings	3	Low weight because there are relatively few developments associated with inholdings.
	Infrastructure supporting inholdings	2	Low weight because there are only two areas where inholdings are supported by infrastructure.
	Undeveloped inholdings	1	Lowest weight because undeveloped inholdings appear natural and the threat of development is considered to be low at this time.
Use of motor vehicles, motorized equipment, or mechanical transport	Legal motorized/ mechanized use	10	Highest weight because these nonconforming uses, while legal in the BWCAW under legislated special provisions, are generally prohibited in wilderness areas per Section 4(c) of the Wilderness Act.
	Administrative motorized/ mechanized use	10	Highest weight because of the variety and frequency of motorized and mechanized administrative use.
	Emergency motorized/ mechanized use	2	Low weight because the amount of emergency use of motorized equipment or mechanized transport is relatively small for such a large and heavily used wilderness.
	Unauthorized motorized/ mechanized use	1	Lowest weight because data on unauthorized motorized and mechanized use are limited and because unauthorized use occurs less frequently than authorized use.

Maps

The weighted measures under each indicator were added together using a raster calculator to create three maps: “non-recreational structures, installations, and developments,” “inholdings,” and “use of motor vehicles, motorized equipment, or mechanical transport” (fig. 8). All the measures were then added together using the same process to create the undeveloped quality map (fig. 9).

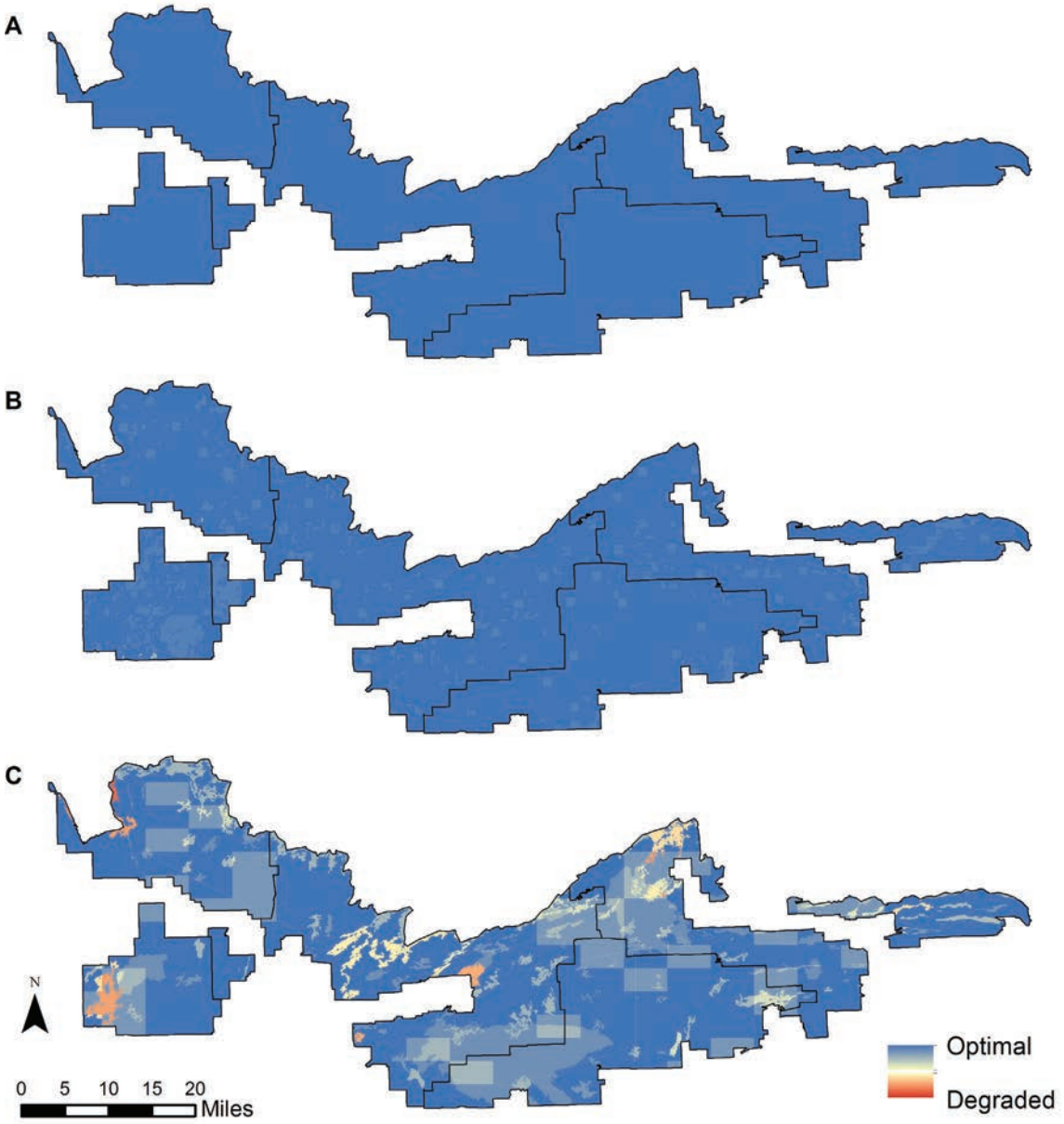

Figure 8—Indicator maps for (A) non-recreational structures, installations, and developments; (B) inholdings; and (C) use of motor vehicles, motorized equipment, or mechanical transport. Blue depicts optimal condition and red depicts degraded condition.

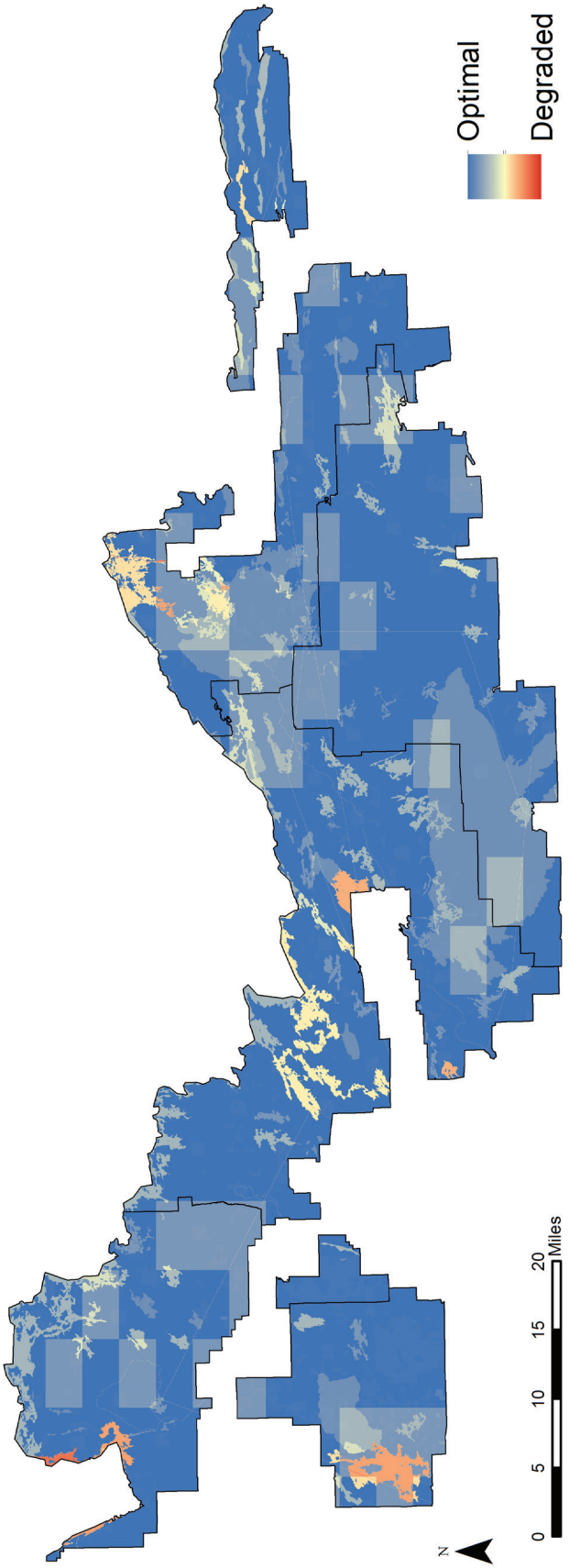

Figure 9—Map of the undeveloped quality of wilderness character. Blue depicts optimal condition and red depicts degraded condition.

Solitude or Primitive and Unconfined Recreation Quality

The solitude or primitive and unconfined recreation quality focuses on the outstanding opportunities that exist in wilderness to experience solitude, remoteness, and primitive recreation free from the constraints of modern society. This quality is degraded by tangible attributes of the setting that reduce these opportunities, such as visitor encounters, signs of modern civilization, recreation facilities, and management restriction on visitor behavior (Landres and others 2008a, 2015).

Indicators and Measures

Keeping it Wild delineates four indicators under the solitude or primitive and unconfined recreation quality. The measures selected for the BWCAW are described below for each of these indicators.

Indicator: Remoteness from sights and sounds of people inside the wilderness.

- Campsite occupancy—Average nightly occupancy of campsites during the primary use season (May 1–September 30). Campsite occupancy levels correspond with how crowded a travel zone is; areas with higher average occupancies have fewer opportunities for visitors to escape the sights and sounds of other people and experience solitude. The BWCAW is one of the most heavily used wildernesses in the country and overcrowding is of particular concern. Occupancy was calculated using a BWCAW-specific visitor use model to predict the average percentage of occupied campsites in a travel zone. Some travel zones do not meet SNF plan standards for visitor occupancy.
- Administrative motorized noise inside wilderness—Areas affected by the sounds of administrative motorized use. Motorized equipment used in wilderness produces a distinctive human-made noise that decreases visitors' sense of remoteness from modern civilization. For this measure, the Forest Service, Border Patrol, USGS, Minnesota DNR, and State and county search and rescue teams are all considered administrative users. The spatial extent of the soundscape for each type of motorized use—including motorboats, airplanes, helicopters, chainsaws, water pumps, drones, all-terrain vehicles, etc.—was determined based on its frequency, the initial decibel level of the sound produced, and its perceived impact on visitor solitude. In the BWCAW, administrative motorized noise is generated through wildlife surveys, fish stocking, trail grooming, fire scouting and fighting, international border protection, and other motorized uses.
- Campsite noise inside wilderness—The maximum extent of potential noise generated by visitors occupying campsites. Auditory impacts from visitors have a significant effect on solitude, especially in water-based wilderness areas. On calm lakes, the cool air and flat water surface amplify sound such that noise from campsites can be heard on the opposite shoreline; lake campsites were therefore depicted with larger noise radiuses than inland sites for this measure. Out of the more than 1,957 designated sites in the BWCAW, the vast majority are on shorelines.

- Commercial outfitter/guides—Routes frequently used by commercial outfitters and guides. Commercial outfitters and guides often have standardized routes that they both recommend to their clients and use in their commercial operations, and they can therefore influence visitor use patterns and opportunities for solitude. The impact of frequently used routes was determined based on the type of commercial use and the magnitude of its associated effects; for example, motorized services during the primary use season were depicted as having a greater effect on solitude than non-motorized winter use. Guided or outfitted excursions in the wilderness include canoeing, kayaking, motorized boating, dogsledding, skiing, snowshoeing, hunting, and fishing. Outfitters and guides also provide towing services on Loon River, La Croix, Trout, South Farm, Fall, Newton, Basswood, Moose, Newfound, Sucker, Snowbank, Seagull, Saganaga, and Clearwater lakes.
- Viewshed inside wilderness—Line of sight impacts of modern human features inside wilderness. The presence of modern features detracts from a sense of solitude. Viewshed analyses depict the line of sight impacts of modern features within wilderness, as determined by their visibility and size. In the BWCAW, modern human features include inholding buildings (21 features), the Saganaga road, administrative structures and installations (472 features), maintained trails and portages (481 miles), roads and portages that allow motorized use (6 features), dams (31 installations), designated campsites (1,957 sites), border markers (1,014 markers), and a single plaque.
- Encounters—Encounter rates per travel zone. The number of other groups seen or encountered in the wilderness has a large impact on visitor perceptions of solitude. The BWCAW has four management areas (pristine, primitive, semi-primitive non-motorized, and semi-primitive motorized) for which different levels of acceptable encounter rates have been set in the SNF plan. Encounter monitoring in the wilderness began in 2008 and is ongoing; while survey data are still incomplete, the preliminary results appear to indicate that some travel zones do not meet SNF plan standards for their management area.
- High use destinations—Routes and sites that are known to receive high amounts of visitor use. Popular and well-known destinations receive increased visitation compared to the rest of the wilderness and are more likely to experience decreased opportunities for solitude. High use destinations include pictograph sites, portages that lead to waterfalls, geologic features, historical sites, natural overlooks, and day use sites. The BWCAW has 23 high use destinations that include over 50 miles of trails. While some sites are being restored and actively managed, the majority of recreational impacts to these locations fall within SNF plan standards.

Indicator: Remoteness from occupied and modified areas outside the wilderness.

- Entry point congestion—Entry points that have known problems with visitor congestion. Designated entry points restrict the locations where visitors are able to enter the wilderness and sometimes create bottlenecks that cause congestion and overcrowding. When multiple visitor groups attempt to enter the wilderness at the same time and place, they end up racing or competing with each other for designated campsites within connected travel routes. These congestion problems

are not isolated to a specific time (e.g., a morning rush) but instead occur throughout the day. Out of 67 total entry points in the BWCAW, 29 of them are known to have frequent congestion problems.

- Utilitarian noise outside wilderness—Areas of wilderness affected by utilitarian noise originating outside of the wilderness. Sounds of modern human civilization adjacent to wilderness can impact wilderness visitors' sense of remoteness. Sources of utilitarian noise include vehicles and chainsaws; because these noises are intermittent, the spatial extent of each source was determined by the initial decibel level of the sound produced. Currently, external utilitarian noise from access and travel routes affects 114,904 wilderness acres while noise from timber harvest units affects 31 wilderness acres.
- Viewshed outside wilderness—Line of sight impacts from modern human features outside of the wilderness. Features of modern civilization located outside of the wilderness can be visible from inside the area and have an effect on visitor solitude. The viewshed analysis for this measure depicted the areas within wilderness where it is possible to observe modern features on the other side of the boundary; the line of sight distance for each feature was determined by its size and visibility. The viewshed analysis included the following external features: communication towers and repeaters (11 sites), roads (964 miles), trails (481 miles), parking lots (10 lots), border swath and boundary markers (1,014 features), campgrounds (13 locations), private structures and associated development (4,633 features), clearcuts (109 locations), recreation sites (48 features), and border monuments (9 monuments).
- Night sky obfuscation—Anthropogenic light ratio (ALR) across the wilderness. Artificial brightening of the night sky obscures the visibility of stars and lessens visitors' sense of solitude. ALR is the proportion of artificial light compared to the brightness of the night sky (for example, an ALR of 0.3 indicates that it is 30 percent brighter than under natural conditions). The BWCAW is relatively protected from artificial light sources by the public lands surrounding it: SNF (to the south), Voyageur's National Park (west), Quetico and La Verandrye Provincial Parks (north and east, respectively), Canadian Crown Land (northeast), Grand Portage National Monument (northeast), and several State parks (east). The largest sources of light nearby are Duluth, Minnesota (~100 miles to the south, with 86,000 people) and Thunder Bay, Ontario (~100 miles to the northeast, with 108,000 people).
- Recreational noise outside wilderness—Areas of wilderness affected by recreational noise originating outside of the wilderness. Sounds of modern human civilization adjacent to wilderness can impact wilderness visitors' sense of remoteness. The spatial extent of each type of motorized recreational use was determined by the initial decibel level of the sound produced. Sources of external recreational noise that affect the wilderness include OHV routes (affecting 258,658 acres of wilderness), snowmobile trails (affecting 243,900 acres), and lakes with motorized use that are adjacent to non-motorized wilderness management areas (affecting 21,298 acres).

Indicator: Facilities that decrease self-reliant recreation.

- Authorized facilities—The locations of designated and maintained recreation facilities. Authorized facilities diminish the need for outdoor skills and decrease opportunities for self-reliance and primitive recreation. Given the high visitation levels in the BWCAW, the Forest Service has installed many recreational facilities to prevent damage to aquatic ecosystems and other natural resources. Wilderness recreational facilities maintained by the Forest Service include five docks and more than 1,957 designated campsites with latrines and fire grates.
- Trails and associated features—Maintained trails and portages. Areas without maintained routes offer extensive opportunities for primitive recreation, such as route-finding or bushwhacking; in contrast, areas with developed trails and portages reduce the need for these types of outdoor skills and promote reliance on managed facilities. Trails frequently have additional constructed features that make visitor experiences easier or more comfortable in wet conditions, including boardwalks, bridges, puncheons, turnpikes, etc. The wilderness contains over 453 miles of maintained portages and trails, many of which contain these types of associated trail features.
- Motorized/mechanized routes—Travel routes that allow motorized use, including tow routes and portages that permit mechanized or motorized travel. In contrast to non-motorized areas that encourage a primitive type of recreation, motorized and mechanized routes allow the use of assisted transportation. For this measure, the degree of impact was considered to be high for portages allowing the use of motorized transport or railcars, moderate for tow routes, and low for trails allowing the use of portage wheels. In the BWCAW, there are 18 tow routes, 2 motorized portages (both on Loon River), 2 portages that allow motorized and mechanized use (Prairie Portage and the Vermillion-Trout Lake portage) and 4 areas that permit the use of portage wheels (portages along the international boundary, Four-Mile Portage, and the Fall-Newton-Pipestone and Back Bay portages into Basswood Lake).
- Wireless coverage—The extent of wireless telephone coverage in the wilderness. The ability to use cell phones to connect with modern civilization while in remote locations diminishes visitors' sense of risk, challenge, and self-reliance. Wireless coverage (for Verizon, T-Mobile, AT&T, and Sprint) extends into the wilderness mainly in the Kawishiwi Ranger District and the Trout unit of the La Croix Ranger District.
- Visitor-created facilities—The locations of known visitor-created recreation facilities. Once created, facilities developed by visitors tend to receive continued use and can become established amenities that decrease opportunities for primitive recreation. Visitor-created facilities include non-designated campsites and fire rings, excessive amounts of camp furniture at designated sites, hunting structures, social trails, cairns, landing jetties, rock cribs, etc. While visitor-created facilities are generally eliminated as soon as they are discovered by SNF staff, there are currently 140 known facilities in the wilderness.

Indicator: Management restrictions on visitor behavior.

- BWCAW rules and regulations—The restrictiveness of regulations for each management area. Rules and regulations for visitors confine and diminish their

sense of freedom. As one of the most heavily used wilderness areas in the NWPS, the BWCAW has many types and levels of visitor restrictions to prevent damage to natural resources and protect opportunities for solitude. Types of regulations include Forest Orders (e.g., prohibitions on cans and glass, prohibitions on pack or saddle animals—except sled dogs—on portages and trails), use restrictions (e.g., group size limits, mandatory permits, reservation system and fees), access restrictions (e.g., mandatory quotas and entry points, closed sites), legislated requirements (e.g., motorized watercraft quotas and hp limits, BWCAW air-space reservation), and special management area limitations (e.g., mandatory pristine management area reservations in addition to standard wilderness reservations). The four management areas of the wilderness have different levels of visitor restrictions. In semi-primitive motorized, semi-primitive non-motorized, and primitive management areas, visitors are required to camp at designated sites. In pristine management areas, in contrast, campsites are not designated or maintained, and visitors are free to choose the location of their site. Visitors are therefore less confined in pristine management areas, despite the additional reservation necessary to access them, than in the rest of the wilderness.

Data Gap Measures

Additional measures under this quality were identified by SNF staff but were excluded for a variety of reasons. For each data gap measure, the indicator, description, and rationale for their dismissal are listed below.

Administrative travel routes

- *Indicator*—Remoteness from sights and sounds of people inside the wilderness.
- *Description*—Administrative routes used by SNF staff. In contrast to visitor use, which is limited by a quota system to preserve opportunities for solitude, there are no explicit restrictions on the amount of administrative use. While SNF staff generally use the same travel routes as visitors, they may occasionally use unofficial access routes as well. Administrative routes include those traveled by all biological or forest technicians for botany, heritage, air and water quality, fisheries, wildlife, fire, visitor/law enforcement, and other wilderness purposes.
- *Rationale for dismissal*—Except for wilderness rangers, most biological or forest technicians have no direct contact with the public while in the wilderness. Although rangers do make public contacts and check permits, these interactions do not seem to have a negative impact on visitors' sense of solitude; to the contrary, BWCAW visitors complain that there are too few contacts with SNF staff.

Visitor motorized noise inside wilderness

- *Indicator*—Remoteness from sights and sounds of people inside the wilderness.
- *Description*—Areas affected by the sounds of motorized recreation. Visitors are prohibited from using motorized equipment in most wilderness areas; where special exemptions have been made, the noise of motorized recreation decreases visitors' sense of remoteness from modern civilization. Recreational use of motorboats and snowmobiles in certain areas of the wilderness was authorized by the Wilderness Act of 1964 and Boundary Waters Canoe Area Wilderness Act of 1978.

- *Rationale for dismissal*—Data on legal motorized recreation in the semi-primitive motorized management area are not available. The administrative motorized use noise measure serves as a proxy for this data gap measure.

Data Sources, Processing, and Cautions

A wide variety of data sources were used to create the solitude or primitive and unconfined recreation quality map. These datasets included both vector and raster data in a range of different scales and with high variability in accuracy and completeness (table 7). The data sources, data processing information, and cautions are listed below for each measure. The viewshed model (used for two measures) is described first as it has a level of complexity beyond the other measures.

Table 7—Solitude or primitive and unconfined recreation quality datasets. Accuracy (how well the dataset represents the measure) and completeness (how complete the dataset is across the wilderness) were evaluated for each measure by SNF staff familiar with these data.

Measure	Source	Type	Scale	Accuracy	Completeness
Campsite occupancy	(1) BWCAW_TravelZones; (2) BWCAW_Vissim work	Polygon and Excel spread-sheet	1:24,000	Medium	Medium
Administrative motorized noise inside wilderness	(1) AuthorizedMotorUseLakes; (2) FireDetectionRoute_LN; (3) international_bdny; (4) MooseHelicopterSurveyAr-eas2013_14; (5) ski_trail; (6) snowmobile; (7) WolfSurveyFlight_LN; (8) BWCAW_StockedLakes1988_201; (9) BWCAW_SpawnTake; (10) BWCAW_DNR_MotorSur-veyLks1978_2013	Polyline and Polygon	1:40,000	Medium	High
Campsite noise inside wilderness	Campsites	Point	1:24,000	High	High
Commercial outfitter/guides	CommercialOutfitterUseUpdate	Polyline	1:63,360	Medium	High
Viewshed inside wilderness	See Table 8				
Encounters	(1) BWCAW_TravelZones; (2) encounters database	Polygon and Excel spread-sheet	1:24,000	Medium	Medium
High use destinations	(1) HighUseDestination; (2) HighUseRoute	Point and Polyline	1:63,360	High	High
Entry point congestion	EntryPointTravelImpact	Polygon	1:24,000	Medium	High
Utilitarian noise outside wilderness	(1) Sound_Roads; (2) Sound_TimberHarvests	Polygon	1:24,000	Medium	Low
Viewshed outside wilderness	See Table 8				
Night sky obfuscation	boundarywatersALR	Raster	900m	Medium	High

Measure	Source	Type	Scale	Accuracy	Completeness
Recreational noise outside wilderness	(1) Sound_ATVs_Version2; (2) Sound_MotorBoats; (3) Sound_Snowmobiles	Polygon	1:24,000	Medium	Medium
Authorized facilities	(1) OpenCampsites; (2) Docks	Point	1:24,000	High	High
Trails and associated features	TrailsPortagesUpdate	Polyline	1:24,000	Low	Low
Motorized/ mechanized routes	AuthorizedAdminRoute	Polyline	1:24,000	High	High
Wireless coverage	MN_Wireless	Polygon	30m	High	High
Visitor-created facilities	(1) SocialTrail; (2) UserCreatedFacilities	Point and Polyline	1:63,360	Low	Low
BWCAW rules and regulations	Management_area	Polygon	1:24,000	High	High

Viewshed inside wilderness and Viewshed outside wilderness

The line of sight visual impacts of modern anthropogenic features inside and outside the BWCAW were modeled using a custom-built software tool. This tool analyzed a variety of inputs—including terrain, land cover, road networks, and all modern human developments occurring in and around the wilderness—to delineate the impacts of modern human features on visitor solitude. To account for edge effects[11] from visible human features immediately outside the wilderness boundary, the viewshed analysis was extended into a 15-kilometer buffer zone around the wilderness.

Viewshed analyses such as these have traditionally been extremely costly in terms of computer processing time. Detailed analyses can take weeks, months, or even years to process depending on the number of anthropogenic features in the database. Previous work on the effects of human features on perceptions of wilderness, carried out at national and global scales, has focused on simple distance measures (Carver 1996; Lesslie 1993; Sanderson and others 2002). Recent improvements to viewshed modeling algorithms have utilized measures of the visibility of anthropogenic features in 3D landscapes using digital terrain models[12] (Carver and Wrightham 2003; Fritz and others 2000). These algorithms calculate the line of sight between a person standing anywhere on a landscape and a particular feature (e.g., a building or radio antennae), and they account for places where this line of sight is interrupted by intervening higher ground.

Incorporating these improvements, Washtell (2007) has shown that it is possible to both dramatically decrease processing times and improve overall accuracy through judicious use of a voxel-based landscape model[13] and a highly optimized ray-casting algorithm.

[11] A problem created during spatial analysis when patterns of interaction or interdependency across borders of the bounded region are ignored or distorted (ESRI 2015).
[12] Digital terrain models are 3D representations of the earth's surface that contain elevation data.
[13] A voxel is a volumetric pixel.

This algorithm, which is similar to those used in real-time rendering applications and in some computer games, was designed to perform hundreds of traditional point viewshed operations per second. By integrating this approach into a custom-built software tool that has been designed to work directly with GIS data, it is possible to estimate the visibility between every pair of cells in a high-resolution landscape model utilizing only moderate computing resources. With this approach (called a "viewshed transform"), an inverse square distance function is used in calculating the significance of visible cells. Put simply, this tool determines the relative viewshed value for each cell by calculating the proportion of the features that can be seen and the distance between the cell and the particular features. Thus, the smaller the proportion of the feature in view and the further away it is, the lower the viewshed value for the particular cell. The greater the proportion of the feature in view and the closer it is, the higher the viewshed value of the particular cell.

In summary, the approach described above represents a maturation of traditional cumulative viewshed techniques (Carver and others 2008) and is used to:

1. Calculate the viewshed for every single feature;
2. Incorporate estimations of the proportional area of each feature that is visible; and
3. Run separate viewshed calculations for categories of features with different viewshed distances, which can then be combined together to create overall viewshed maps.

Sources—The viewshed transform tool was used to conduct the viewshed analyses for modern human features inside and outside the BWCAW. Viewshed analyses rely on the ability to calculate the line of sight from one point on a landscape to another. It has been shown that the accuracy of a viewshed analysis produced in GIS is strongly dependent on the accuracy of the terrain model used and the inclusion of intervening features or "terrain clutter" (Fisher 1993). While previous studies have made use of a digital surface model (DSM)[14] for obtaining terrain clutter data (Carver and others 2008), the large spatial extent of the BWCAW and the relative lack of anthropogenic features allows feature information to be collated and formatted manually. A resolution of 30 meters for feature inputs was considered adequate for this analysis. The USGS 10-meter Digital Elevation Model (DEM) was resampled to 30 meters to provide the base terrain elevation data. The DEM was then augmented with surface data, including both land cover data and anthropogenic features. The land cover data were created by assigning heights (provided by Kathleen McTighe, SNF Silviculturist) to the different classes in the original land cover dataset (Wolter and others 1995). Modern anthropogenic features in and adjacent to the BWCAW were identified by the project core team; viewshed distance and height information were then assigned for each feature (table 8).

[14] Digital surface models are a type of terrain model that include objects on the surface of the earth, such as buildings, vegetation, or other features.

Processing—Two data inputs are required for the viewshed model: (1) a terrain layer and (2) a viewshed feature layer. The terrain layer is a model of the environment being analyzed. The feature layer is used to identify the features being analyzed in the terrain model and sets their associated viewshed distances. The major processing tasks performed for the terrain layer are summarized chronologically below:

1. The USGS 10-meter DEM was resampled to 30 meters.
2. The height information was related to the land cover dataset (Wolter and others 1995).
3. The land cover dataset was converted to raster at 30 meters, setting the pixel values to the height information.
4. All viewshed features (listed in table 8) were converted to raster at 30 meters, setting the pixel values to the height information.
5. The viewshed features were combined together using the Mosaic to New Raster tool[15]. The merge order was set from the tallest features to the shortest (such that taller features are given priority when features overlap).
6. The combined viewshed features were added to the land cover raster using the Mosaic to New Raster tool, giving priority to the viewshed features (such that features always override the land cover heights wherever they occur).
7. The above raster was added to the DEM using the raster calculator.
8. The raster was converted to a floating point grid (as required by the viewshed software).

The major processing tasks performed for the viewshed feature layer are summarized chronologically below:

1. All viewshed features (listed in table 8) were converted to raster at 30 meters, setting the pixel values to the height information.
2. The viewshed features were combined together for each viewshed distance category (120 meters, 500 meters, 1 kilometer, 5 kilometers, and 15 kilometers) using the Mosaic to New Raster tool.
3. Each of the rasters for the viewshed distance categories was converted to a floating point grid (as required by the viewshed software).

The software was used to analyze the viewshed distance categories for both features inside wilderness (three categories) and features outside wilderness (four categories) (see table 8). When necessary for the analysis of a distance category, the viewshed landscape was split into a number of overlapping tiles such that they could be simultaneously analyzed by a cluster of desktop computers.

The model outputs for the different viewshed distances were combined using the MINIMUM function in ArcGIS to produce grids of viewshed impacts for features inside and adjacent to the wilderness. Raster values were normalized to 0–255. The normalized values were then inverted to reflect high degradation of solitude near human features and lower degradation further away from those features (fig. 10).

[15] Merges multiple raster datasets into a new raster dataset (ESRI 2015).

Cautions—The viewshed model replicates the natural environment using a number of rules and compromises. While necessary for the purposes of this analysis, these compromises should be carefully considered when discussing results.

1. For this analysis, a "pessimistic" resampling was done to generate the 30-meter feature inputs guaranteeing that features smaller than this area were included[16] and that the viewsheds produced an accurate representation of the visual impacts of these features.
2. Categorizing the anthropogenic features in and adjacent to the BWCAW into specific viewshed distances requires careful consideration as to how well each type of feature may blend in with the local background. For example, border markers are largely unnoticeable at a distance because of their shape and profile; they were therefore assigned a maximum viewshed distance of 120 meters. Larger and more prominent features, such as the communication towers and repeaters, were assigned a maximum viewshed distance of 15 kilometers.
3. The viewshed analysis may not realistically represent certain resampled feature inputs. For example, utility poles and powerlines in the Saganaga corridor are represented in the model as a solid 2-meter high "wall," even though those features are significantly less visible than a wall would be.
4. The current version of the viewshed tool places the "person" in the analysis on top of all the viewshed features (such as vegetation or buildings), as opposed to placing them in among those features. Areas where the vegetation exceeds 3 meters must therefore be removed manually from the output. This limitation is being addressed for future versions of the software.

[16] Resampling of feature layers in GIS is normally carried out on a "majority class" basis wherein the value of a grid cell takes on the value of the largest feature by area that it contains. Using this rule, a 10 x 10 meters building in a 30 x 30 meters grid cell that was otherwise not classified as a feature would not be recorded on resampling. The "pessimistic" resampling used here operates on presence/absence basis such that any grid cell containing a human feature will be classified as such even though the actual area or footprint of the feature may not cover the majority of the grid cell.

Table 8—Modern human features impacting viewshed.

Features INSIDE wilderness	Data source	Viewshed distance (kilometers)	Height (meters)	Accuracy	Completeness
Inholding buildings and associated developments	StructureNonFS	1	3, 4, or 6	High	High
Administrative buildings and docks	AuthorizedPhysicalDevlopment	1	3 or 4 = buildings; 1.5 = docks	High	High
Trails/portages (water bars, tread, turnpike, puncheon)	TrailsPortagesUpdate	0.5	1	Low	Low
Motorized portages/ roads	MotorizedPortages	1	1.5	High	High
Dams	DamsBWCAW.shp	1	2	High	High
Campsites	OpenCampsites	1	2	High	High
Eagle Mountain plaque	AuthorizedPhysicalDevlopment	0.5	2	Medium	High
Border markers	AuthorizedPhysicalDevlopment	0.12	1	Medium	High
Power line poles and associated roads	InholdingSupportFeature	0.5	2	High	High
Features OUTSIDE wilderness	**Data source**	**Viewshed distance (kilometers)**	**Height (meters)**	**Accuracy**	**Completeness**
Communication towers/repeaters	TowersPublic15k	15	Antenna height	Medium	High
Roads	SNF_Road5k	5	2	High	High
Trails	TrailOutWithin5k	0.5	1	High	High
Parking lots	ParkingLot	5	2	High	High
Border swath/markers	AuthorizedPhysicalDevlopment	0.12	1	Medium	High
Campgrounds	CampgroundWithin5k_PL	5	2.5	High	High
Private structures and associated developments	StructuresWithin5k_PT; Queti-coStructures	5	6	Medium	Low
Clearcuts	Clearcuts2009_2013	5	1	High	Medium
Recreation sites	RecSiteWithin5k	5	2	High	High
Border monuments	BorderMonument	0.5	1	Medium	High

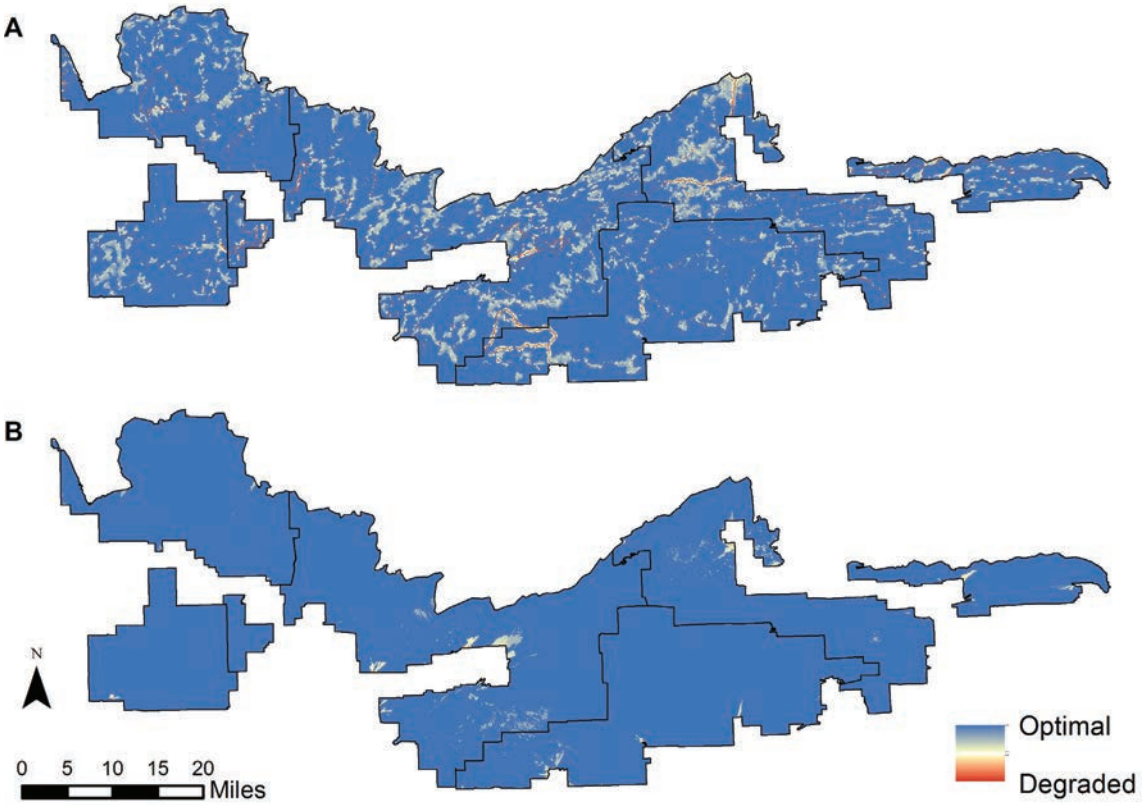

Figure 10—Viewshed impacts for (A) features inside the wilderness and (B) features outside the wilderness. Blue depicts optimal condition and red depicts degraded condition.

Campsite occupancy

- *Sources*—(1) Polygon dataset of BWCAW travel zones; (2) BWCAW travel simulation model (VisSim3.0). The VisSim3.0 is based on actual itineraries contributed by over 11,000 BWCAW visitor groups after their trips in 2011, and it accounts for the unique travel patterns of visitors as they choose from 61 entry points and travel through 95 backcountry travel zones and Quetico Provincial Park. The model was run 5 times to simulate 5 scenarios of campsite occupancy across the wilderness over the course of the primary use season (May 1–September 30); the average predicted occupancy for each travel zone was calculated from the 5 datasets produced (Ann Schwaller, SNF Wilderness Specialist).
- *Processing*—The model output was joined to the travel zones dataset; values were assigned to each travel zone from the average modeled data. The layer was converted to raster and the values were normalized to 0–255.
- *Cautions*—A number of assumptions are inherent to the travel simulation model. If a travel zone is full or closed, a simulated group will move to the next travel zone on their itinerary (if possible) and stay an extra day in the new zone to maintain the same overall trip length. If the closed zone is the last or only zone on the group's itinerary, the trip will be cut short. If no zones on the assigned itinerary are available, the group will be assigned a new itinerary. The model does not account for camping in undesignated areas or for two or more groups camping at

a single site; however, these behaviors can be simulated by increasing the visitor capacities of the travel zones where these situations are known to occur.

Administrative motorized noise inside wilderness

- *Sources*— (1) Polygon dataset of BWCAW lakes where motorized use is authorized, derived from the National Hydrography Dataset (www.nhd.usgs.gov); (2) polyline dataset of fire detection routes (Chippewa and Superior National Forest Dispatch); (3) polyline dataset of international boundary patrols (SNF District Wilderness Staff and SNF Law Enforcement); (4) polygon dataset of moose surveys (Tom Rusch, Minnesota DNR Wildlife Supervisor); (5) polyline dataset of groomed ski trails (SNF District Wilderness Staff); (6) polyline dataset of snowmobile trails (SNF District Wilderness Staff); (7) polyline dataset of wolf survey flights (Chippewa and Superior National Forest Dispatch); (8) polygon dataset of lakes stocked with fish, created by relating fish stocking records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov); (9) polygon dataset of lakes where fish spawn collection occurred, created by relating spawn collection records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov); (10) polygon dataset of fish surveys using motorized access, created by relating information on fish survey methodologies (2015 SNF and Minnesota DNR Memorandum of Understanding on fisheries management within the BWCAW) and fisheries records (Lyn Bergquist, Minnesota DNR GIS Program Coordinator) to the National Hydrography Dataset (www.nhd.usgs.gov).
- *Processing*—All sources of administrative motorized noise were buffered to account for the distance sound travels. The buffer distances for aircraft overflights (5 kilometers or 0 kilometers) were determined through group consensus based on the experiences of SNF District Wilderness Staff. For snowmobile and motorboat use, the buffer distances (686 meters and 976 meters, respectively), were determined by inputting a starting decibel into a sound attenuation formula (vetted by Dan Mennitt, Colorado State University Research Scientist) to determine how far the sound must travel to be reduced to the level of "secluded woods." The administrative noise sources were ranked with the following values by the project core team to depict the differences in their perceived impacts to visitor solitude:
    - 3 = International boundary flights (5 kilometer buffer)
    - 3 = Moose survey flights (no buffer)
    - 5 = Wolf survey flights (5 kilometer buffer)
    - 5 = Ski trail grooming with snowmobiles (686 meter buffer)
    - 5 = Fish survey and stocking flights (5 kilometer buffer)
    - 6 = Fish survey and spawn collection with motorboats (976 meter buffer)
    - 8 = Fire flights (5 kilometer buffer)
    - 10 = Snowmobile trails (686 meter buffer)
    - 10 = Lakes authorized for motorized use (976 meter buffer)

  Layers were converted to individual rasters and added accumulatively. Values were then normalized to 0–255.

- *Cautions*—The polyline of the international boundary does not represent the specific locations or frequency of actual Border Patrol motorized/mechanized use. The Border Patrol does not release their data on nonconforming wilderness uses to the SNF; the SNF will continue to work with the DHS to try to obtain this information in a way that meets national security needs. Similarly, the polygon dataset of fish survey locations using motorized access is most likely an underrepresentation of the actual impact. Data indicating whether or not fish surveys used motorized access were unavailable for small, non-remote lakes (i.e., lakes smaller than 450 acres that are accessible by [1] 4 portages or fewer that are cumulatively less than a mile in distance, [2] less than 15 miles of motorized water travel, or [3] less than 5 miles of non-motorized water travel); however, it is considered possible that fish surveys on these lakes used motorized access. The polygon dataset of moose survey plots does not reflect the actual amount of motorized use as data on the specific flight paths used for both accessing plots and conducting surveys were unavailable; no buffer was assigned to this noise source as the polygon itself was considered to provide sufficient representation of the known sound impacts. Additionally, data on annual bald eagle nest detection flights and data on occasional U.S. Coast Guard motorized/mechanized use in wilderness were unavailable at the time of mapping. Linear buffers for administrative noise sources offer a rough estimation of sound impact and do not account for variability introduced by terrain or vegetation. Sounds from administrative noise are not constant and activity is variable; therefore wilderness areas depicted as being affected by administrative noise may or may not be impacted at any given moment. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Campsite noise inside wilderness

- *Sources*—Point dataset of campsite locations in the BWCAW (Teresa Hanson, SNF GIS Analyst, and Ann Schwaller, SNF Wilderness Specialist).
- *Processing*—Campsite noise was buffered 100 meters on land and 500 meters over water to account for differences in how sound travels. These buffer distances were determined through group consensus based on the experiences of SNF District Wilderness Staff. Buffered campsite locations were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—Linear buffers for campsite noise offer a rough estimation of sound impact and do not account for variability introduced by terrain or vegetation. Sounds from visitors at campsites are not constant and activity is variable; therefore, wilderness areas depicted as being affected by campsite noise may or may not be impacted at any given moment. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Commercial outfitter/guides

- *Sources*—Polyline dataset of outfitter/guide routes in the BWCAW (SNF District Wilderness Staff).

- *Processing*—The various types of outfitter/guide routes were ranked with the following values by the project core team to depict the differences in their season of commercial use and the magnitude of their effects on other visitors:
  - 1 = Winter dogsled
  - 3 = Summer recreation
  - 4 = Summer recreation and winter dogsled
  - 7 = Summer recreation with motorized towing
  - 8 = Summer recreation with motorized towing and winter dogsled

  The layer was converted to raster and the values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Encounters

- *Sources*— (1) Polygon dataset of BWCAW travel zones; (2) SNF encounter database (a Microsoft Excel spreadsheet with records of encounter rates per travel zone, SNF District Wilderness Staff and Ann Schwaller, SNF Wilderness Specialist).
- *Processing*—The database was joined to the travel zones dataset; values were assigned to each travel zone from the data in the database. The layer was converted to raster and the values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

High use destinations

- *Sources*— (1) Point dataset of high use destinations (SNF District Wilderness Staff); (2) polyline dataset of high use routes, created by relating institutional knowledge (SNF District Wilderness Staff) to the SNF trail feature class.
- *Processing*—High use points were buffered by 250 meters to reflect increased visitation around these destinations. Locations of destinations and routes of high use were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Entry point congestion

- *Sources*—Polygon dataset of busy/congested entry point lakes and portages, created by relating institutional knowledge (SNF District Wilderness Staff and Ann Schwaller, SNF Wilderness Specialist) to the National Hydrography Dataset (www.nhd.usgs.gov) and the SNF trail feature class.
- *Processing*—Congested entry points were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Utilitarian noise outside wilderness

- *Sources*—Polygon datasets of utilitarian noise impacts inside wilderness from: (1) roads outside wilderness; (2) timber harvest locations outside wilderness. Both datasets were created by buffering point datasets of noise sources; buffer distances were determined using a sound attenuation model to calculate the distance it takes the starting decibel levels (of [1] vehicles on different road surfaces and [2] timber harvest operations) to be reduced to natural ambient noise levels (Menge and others 1998, 2002; Teresa Hanson, Forest GIS Analyst).
- *Processing*—Areas of utilitarian noise impacts inside the wilderness were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—It is conservatively assumed that the median (L50) ambient sound level in the analysis area is 34 A-weighted decibels (dBA, the relative loudness of sounds as perceived by the human ear) during the day (Federal Hardrock Mineral Prospecting Permit Environmental Impact Statement, page 92) (USDA Forest Service 2012). Sounds from utilitarian sources are not constant and activity is variable; therefore, wilderness areas depicted as being affected by utilitarian noise may or may not be impacted at any given moment. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Night sky obfuscation

- *Sources*—Raster dataset of a TIFF (tagged image file format) image depicting the average ALR across the wilderness, obtained from the NPS Natural Sounds and Night Skies Division (Dan Duriscoe, NPS Physical Scientist). The dataset is based on a GIS model of anthropogenic sky luminance (calibrated to other ground-based measures) utilizing data from the 2001 World Atlas of Night Sky Brightness (which depicts zenith sky brightness, i.e., the brightness of the sky directly above the observer). A neighborhood analysis was applied to the original data to determine the anthropogenic brightness over the entire sky; the modeled anthropogenic sky brightness data were then presented as a ratio (ALR) over the natural level of sky brightness.
- *Processing*—The raster dataset was re-projected and values were normalized to 0–255.
- *Cautions*—There is a moderate level of uncertainty with the modeled data.

Recreational noise outside wilderness

- *Sources*—Polygon datasets of recreational sound impacts inside wilderness from: (1) vehicle routes outside wilderness; (2) motorized lakes outside wilderness, derived from the National Hydrography Dataset (www.nhd.usgs.gov); (3) snowmobile routes outside wilderness. All three datasets were created by buffering point datasets of noise sources; buffer distances were determined using a sound attenuation model to calculate the distance it takes the starting decibel levels of (1) OHVs, (2) boats, and (3) snowmobiles to be reduced to natural ambient noise levels (Menge and others 1998, 2002; Teresa Hanson, SNF GIS Analyst).

- *Processing*—Areas of recreational noise impacts inside the wilderness were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—It is conservatively assumed that the median (L50) ambient sound level in the analysis area is 34 dBA during the day (Federal Hardrock Mineral Prospecting Permit EIS, page 92) (USDA Forest Service 2012). Sounds from recreational sources are not constant and activity is variable; therefore, wilderness areas depicted as being affected by recreational noise may or may not be impacted at any given moment. The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Authorized facilities

- *Sources*—(1) Point dataset of Forest Service-maintained docks in the BWCAW (SNF District Wilderness Staff); (2) point dataset of Forest Service-maintained designated campsites in the BWCAW (SNF District Wilderness Staff and Ann Schwaller, SNF Wilderness Specialist).
- *Processing*—Locations of campsites and docks were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Trails and associated features

- *Sources*—Polyline dataset of Forest Service-maintained trails and portages in the BWCAW (SNF District Wilderness Staff).
- *Processing*—Locations of trails and portages were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Motorized/mechanized routes

- *Sources*—Polyline dataset of mechanical/motorized portages and tow routes, (SNF District Wilderness Staff and Ann Schwaller, SNF Wilderness Specialist).
- *Processing*—The locations of mechanical/motorized portages and tow routes were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Wireless coverage

- *Sources*—Polygon dataset of wireless coverage in the BWCAW, obtained from the National Broadband Map (U.S. Department of Commerce 2015).

- *Processing*—Data were queried to select the following four major cellular networks: Sprint, Verizon Wireless, T-Mobile, and AT&T. Areas of wireless coverage were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Visitor-created facilities

- *Sources*—(1) Polyline dataset of social trails (SNF District Wilderness Staff); (2) point dataset of campsites with visitor-created facilities, created by relating institutional knowledge of known unauthorized facilities (SNF District Wilderness Staff) to the BWCAW campsite dataset.
- *Processing*—Locations of visitor-created facilities were assigned a value of 1. Layers were converted to individual rasters and added together. Values were then normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

BWCAW rules and regulations

- *Sources*—Polygon dataset of management areas in the BWCAW.
- *Processing*—Pristine management areas (less restrictive) were assigned a value of 1, and remaining management areas were assigned a value of 2. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Weighting

The assigned weight (on a scale of 1 to 10) and the corresponding rationale for each measure under the solitude or primitive and unconfined recreation quality are described in table 9.

Maps

The weighted measures under each indicator were added together using a raster calculator to create four maps: "remoteness from sights and sounds of people inside the wilderness," "remoteness from occupied and modified areas outside the wilderness," "facilities that decrease self-reliant recreation," and "management restrictions on visitor behavior" (fig. 11). Two supplementary maps of opportunities for solitude (created by adding together the measures under the first two indicators) and opportunities for primitive and unconfined recreation (created by adding together the measures under the last two indicators) were also produced for management purposes (fig. 12). All the measures were then added together using the same process to create the solitude or primitive and unconfined recreation quality map (fig. 13).

Table 9—Measure weights and rationales for the solitude or primitive and unconfined recreation quality.

Indicator	Measure	Weight	Rationale
Remoteness from sights and sounds of people inside the wilderness	Campsite occupancy	8	High weight because campsite occupancy is a planning indicator for the BWCAW, and because it correlates with current ecological and social impacts.
	Administrative motorized noise inside wilderness	8	High weight because the BWCAW has a considerable amount of regular administrative motorized use.
	Campsite noise inside wilderness	6	Medium weight because the BWCAW has a significant number of designated campsites and high visitor use; visitors have complained about the impact of campsite noise carrying across the water.
	Commercial outfitter/guides	6	Medium weight because commercial use is prevalent in three of the four management areas.
	Viewshed inside wilderness	5	Medium weight because most features in the wilderness are obscured by thick vegetation and are less noticeable from the main travel routes.
	Encounters	4	Low weight because encounter monitoring is ongoing and data are not yet complete.
	High use destinations	3	Low weight because the number of high use routes and sites is relatively low, and the recreational impacts generally do not exceed SNF plan standards.
Remoteness from occupied and modified areas outside the wilderness	Entry point congestion	5	Medium weight because congestion is problematic for less than half of all entry points.
	Utilitarian noise outside wilderness	3	Low weight because only a small portion of the lands adjacent to the BWCAW are sources of significant utilitarian noise.
	Viewshed outside wilderness	3	Low weight because many features are obscured by thick vegetation and less noticeable from the main visitor travel routes.
	Night sky obfuscation	3	Low weight because impacts to the night sky are relatively low.
	Recreational noise outside wilderness	2	Low weight because only a small portion of the lands adjacent to the BWCAW are sources of significant recreational noise.
Facilities that decrease self-reliant recreation	Authorized facilities	10	Highest weight because of the large number of designated campsites, all of which have recreational facilities.
	Trails and associated features	7	High weight because trails and portages are prevalent throughout the wilderness and many have associated constructed features.
	Motorized/mechanized routes	4	Low weight because there are only a limited number of tow routes and portages allowing motorized or mechanized use.
	Wireless coverage	2	Low weight because the ratio of wireless coverage to wilderness acres is low. The weight could increase in the future if existing towers are improved or new towers are erected.
	Visitor-created facilities	1	Lowest weight because most user-created facilities are eliminated/naturalized by SNF staff upon discovery.
Management restrictions on visitor behavior	BWCAW rules and regulations	5	Medium weight because the numerous management regulations currently in place are considered necessary for the protection of other wilderness values.

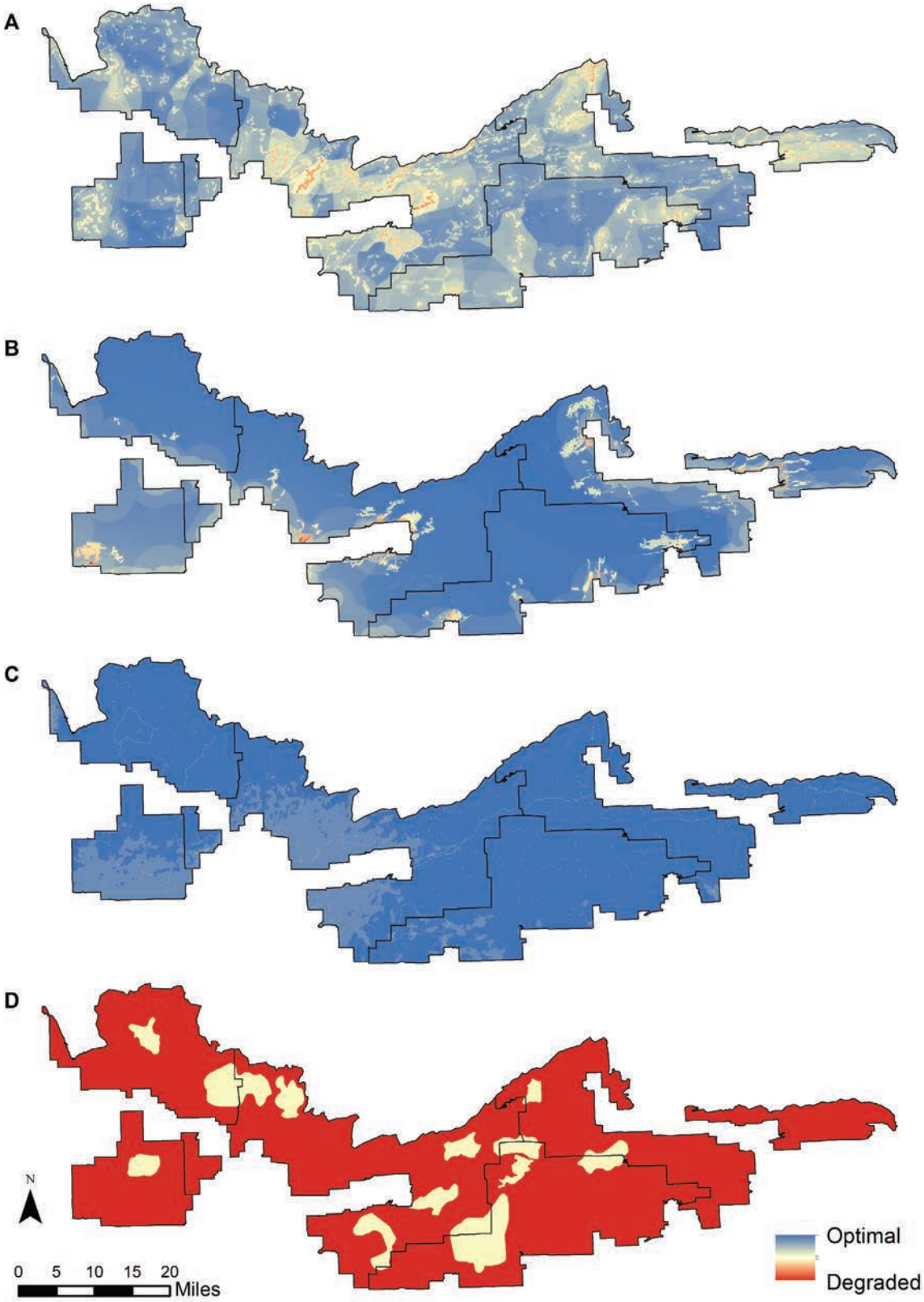

Figure 11—Indicator maps for (A) remoteness from sights and sounds of people inside the wilderness, (B) remoteness from occupied and modified areas outside the wilderness, (C) facilities that decrease self-reliant recreation, and (D) management restrictions on visitor behavior. Blue depicts optimal condition and red depicts degraded condition.

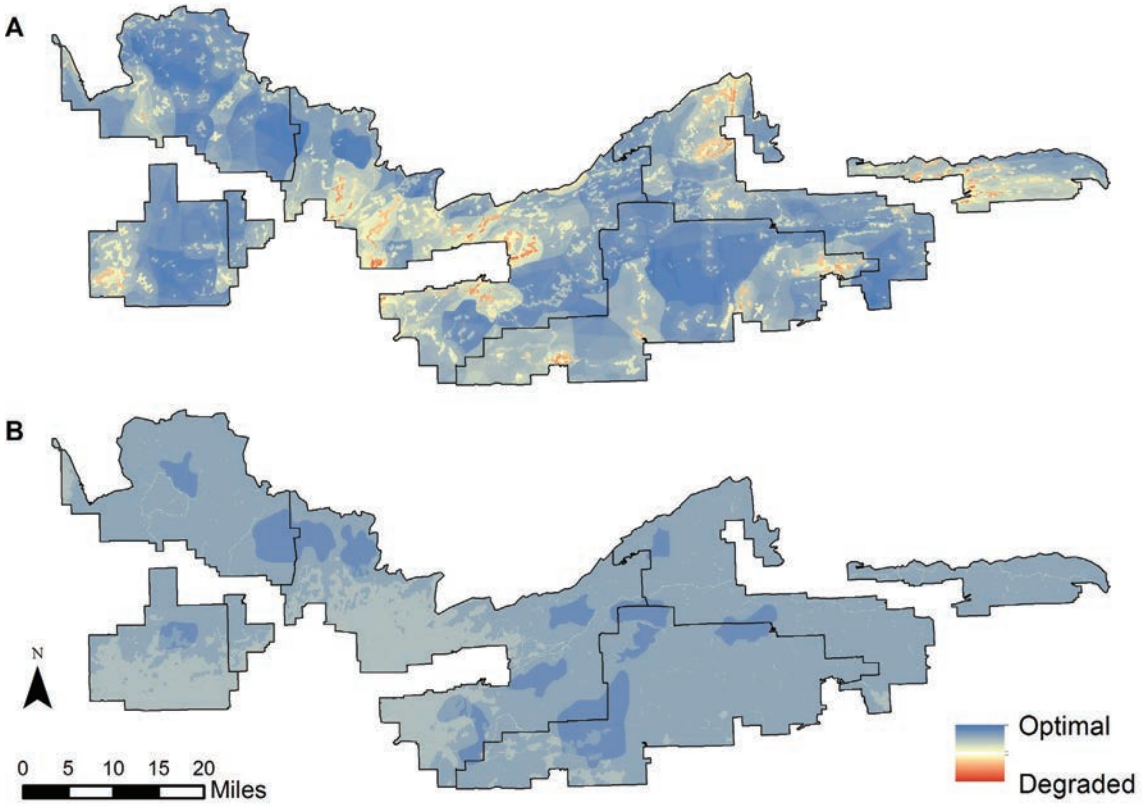

Figure 12—Combined indicator maps for (A) opportunities for solitude inside wilderness, and (B) opportunities for primitive and unconfined recreation inside wilderness. Blue depicts optimal condition and red depicts degraded condition.

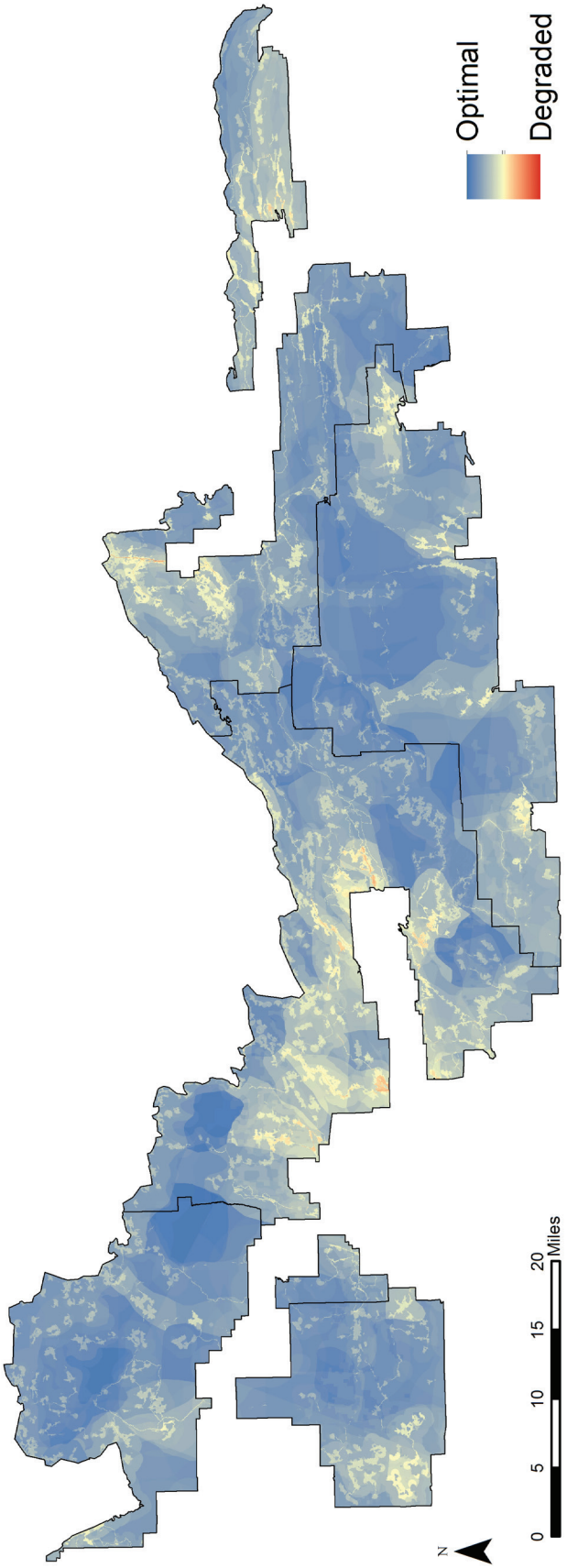

Figure 13—Map of the solitude or primitive and unconfined recreation quality of wilderness character. Blue depicts optimal condition and red depicts degraded condition.

Other Features of Value Quality

The other features of value quality centers on unique and tangible features of a wilderness that are integral to the wilderness character of that place. These features may include cultural resource sites, paleontological sites, or any other features not included under the other four qualities that have ecological, geological, scientific, educational, scenic, or historical value (Landres and others 2012, 2015). This quality is degraded by loss or damage to other features integral to wilderness character.

Indicators and Measures

Two indicators were selected for this quality based on the other features of value present in the BWCAW. These indicators are: "prehistoric cultural resources integral to wilderness" and "historic cultural resources integral to wilderness." The measures selected for the BWCAW are described below for each of these indicators.

Indicator: Prehistoric cultural resources integral to wilderness.

- Unauthorized disturbances to prehistoric cultural resources—Campsites where prehistoric sites have potentially been impacted. Prehistoric cultural resources that are integral to wilderness character cannot be recovered once they are damaged or lost. Cultural resources are at risk from both unintentional activities (such as erosion or compaction caused by heavy use of a site) as well as deliberate unauthorized actions (such as looting or vandalism). Designated campsites frequently overlay prehistoric sites in the BWCAW, and there are currently 170 cultural resource sites co-located with modern campsites that exhibit moderate or high impacts from visitor use. For this measure, prehistoric sites that have already been impacted by soil loss were depicted as being more degraded than unevaluated sites at risk of disturbance. Of the 170 sites, 41 have already lost site integrity and are no longer eligible for the National Register of Historic Places; the remaining 129 sites have not yet been evaluated.

Indicator: Historic cultural resources integral to wilderness.

- Unauthorized disturbances to historic cultural resources—The locations and conditions of intact historic structures. Historic sites integral to wilderness character are irreplaceable cultural resources. Evidence of historical occupation can be found throughout the BWCAW, but relatively few structures remain intact. In addition to being important cultural resources, these buildings are also used for administrative purposes. The Kekakabic and La Croix Guard Stations, Crooked Lake Boathouse, and Prairie Portage Cabin are all eligible for the National Register of Historic Places, while the Beatty Portage Cabin and Little Saganaga State Cabin have not yet been evaluated.

Data Gap Measures

Additional measures under this quality were identified by SNF staff but were excluded for a variety of reasons. For each data gap measure, the indicator, description, and rationale for their dismissal are listed below.

Authorized disturbances to prehistoric cultural resources

- *Indicator*—Prehistoric cultural resources integral to wilderness.
- *Description*—SNF management activities may occasionally degrade prehistoric cultural sites. Such actions may include campsite or portage restoration projects, latrine digging, and other general maintenance work.
- *Rationale for dismissal*—Authorized actions that impact prehistoric sites are partially addressed by a different measure under the untrammeled quality. The Forest Service completes minimum requirements analyses for all projects in wilderness that include an assessment of impacts to cultural resources integral to wilderness character.

Authorized disturbances to historic cultural resources

- *Indicator*—Historic cultural resources integral to wilderness.
- *Description*—SNF management activities may occasionally degrade historic cultural sites. Such authorized actions may include remodeling historic buildings or permitting administrative uses that interfere with the historical integrity of a site.
- *Rationale for dismissal*—The Forest Service completes minimum requirements analyses for all projects in wilderness that include an assessment of impacts to cultural resources integral to wilderness character. The Forest Service also follows Secretary of the Interior standards for the treatment of historic structures.

Data Sources, Processing, and Cautions

The other features of value quality datasets are all vector data, of fine scale, with high levels of accuracy and completeness (table 10). The data sources, data processing information, and cautions are listed below for each measure.

Table 10—Other features of value quality datasets. Accuracy (how well the dataset represents the measure) and completeness (how complete the dataset is across the wilderness) were evaluated for each measure by SNF staff familiar with these data.

Measure	Source	Type	Scale	Accuracy	Completeness
Unauthorized disturbances to prehistoric cultural resources	ExposedSoils_Heritage	Point	1:24,000	High	High
Unauthorized disturbances to historic cultural resources	Cabins	Point	1:24,000	High	High

Unauthorized disturbances to prehistoric cultural resources

- *Sources*—Point dataset of campsites with exposed soil where prehistoric sites have or may have been impacted, created by relating institutional knowledge of campsites with exposed soil (SNF District Wilderness Staff) and prehistoric site locations (SNF heritage staff) to the BWCAW campsite dataset.
- *Processing*—Evaluated prehistoric sites known to have been impacted by soil loss were assigned a value of 2, and unevaluated prehistoric sites with exposed soil were assigned a value of 1. The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Unauthorized disturbances to historic cultural resources

- *Sources*—Point dataset of historic cabins and outhouses in the BWCAW.
- *Processing:* The various historic structures were ranked on a scale of 1 (excellent) to 5 (poor) to depict the differences in their condition and eligibility for the National Register of Historic Places (Lee Johnson, SNF Archaeologist). The layer was converted to raster and values were normalized to 0–255.
- *Cautions*—The information contained in these data is dynamic and may change over time. The data are not better than the original sources from which they were derived.

Weighting

The assigned weight (on a scale of 1 to 10) and the corresponding rationale for each measure under the other features of value quality are described in table 11.

Table 11—Measure weights and rationales for the other features of value quality.

Indicator	Measure	Weight	Rationale
Prehistoric cultural resources integral to wilderness	Unauthorized disturbances to prehistoric cultural resources	10	Highest weight because prehistoric cultural sites are irreplaceable and at a high risk for damage or loss.
Historic cultural resources integral to wilderness	Unauthorized disturbances to historic cultural resources	10	Highest weight because few historic structures remain intact in the wilderness.

Maps

The weighted measures under each indicator were added together using a raster calculator to create two maps: "management of prehistoric cultural resources integral to wilderness" and "management of historic resources integral to wilderness." All the measures were then added together using the same process to create the other features of value quality map. Although the measures selected for this quality contributed to the overall map of threats to wilderness character, the indicator and quality maps are excluded from this report due to the sensitive nature of the cultural resource data.

Map of Threats to Wilderness Character

Interpreting the map products generated by this project requires a clear understanding of the methods that were used and their associated limitations. For example, the maps for the natural and solitude or primitive and unconfined recreation qualities used both vector and continuous raster data sources and are distinctly different in appearance from the maps for the qualities that only used vector data sources. Furthermore, some datasets were depicted as being spread uniformly across an area when in reality the impact was concentrated to specific locations within that area (e.g., visitor use was depicted evenly across each travel zone even though certain campsites receive more use than others). In addition, it is important to bear in mind that the maps were generated through the analysis of a multitude of datasets; to understand why certain areas are degraded one must "drill down" into the individual qualities, indicators, and measures.

The methodology described in the previous sections produced maps for each of the 53 weighted measures; these were then added together accumulatively to produce a single map of threats to wilderness character in the BWCAW (fig. 14). The map of threats to wilderness character represents a grid of values (approximately 5 million pixels at a 30 meter resolution), and it uses a blue-red color ramp and the "minimum-maximum" stretching technique to best represent those values for display and discussion. An equal interval reclassification[17] of the overall map was performed to transform the range of values for all pixels onto a scale of 0 (most degraded condition, highest cumulative threat level from all measures) to 100 (optimal condition, no threats to wilderness character). These values were then split into 10 equal categories (i.e., 0–10, 11–20, 21–30, etc.) to clearly emphasize the variation in the magnitude of threats to wilderness character across the BWCAW (fig. 15).

The histogram of the distribution of pixel values (fig. 16) shows that most pixels fall within the 71–80 or 81–90 categories, indicating that the majority of the wilderness has high quality wilderness character that has not been substantially impacted by threats. Overlaying the map of threats to wilderness character with a map of BWCAW waterbodies reveals that patterns and variations in the magnitude of threats are strongly linked to lakes for both high quality and degraded areas. The lowest quality categories are highly correlated with lakes that allow motorized use, especially those that are wilderness entry points. The lowest four categories (0–40) are primarily clustered around the end of the Gunflint Trail (Saganaga and Seagull lakes) and the Fernberg Road (Snowbank, Parent, Moose, Newfound, Found, Basswood—especially Pipestone Bay, Newton, Fall, and South Farm lakes). Additional areas within these categories include lakes in the Trout Lake and Vento units (Trout, Clearwater, Duncan, and East Bearskin lakes), Paulson Lake (south of Seagull Lake), and a small portion of Knife Lake (near Thunder Point). Of the 17 lakes within the lowest 4 categories, 12 allow motorized use (encompassing more than half of all motorized lakes in the wilderness), 8 are motorized entry point lakes, and an additional 6 are easily accessible via a short portage from an entry point.

[17] This reclassification scheme divides the range of attribute values into equal-sized sub-ranges, allowing the user to specify the number of intervals while ArcMap determines where the breaks should occur (ESRI 2015).

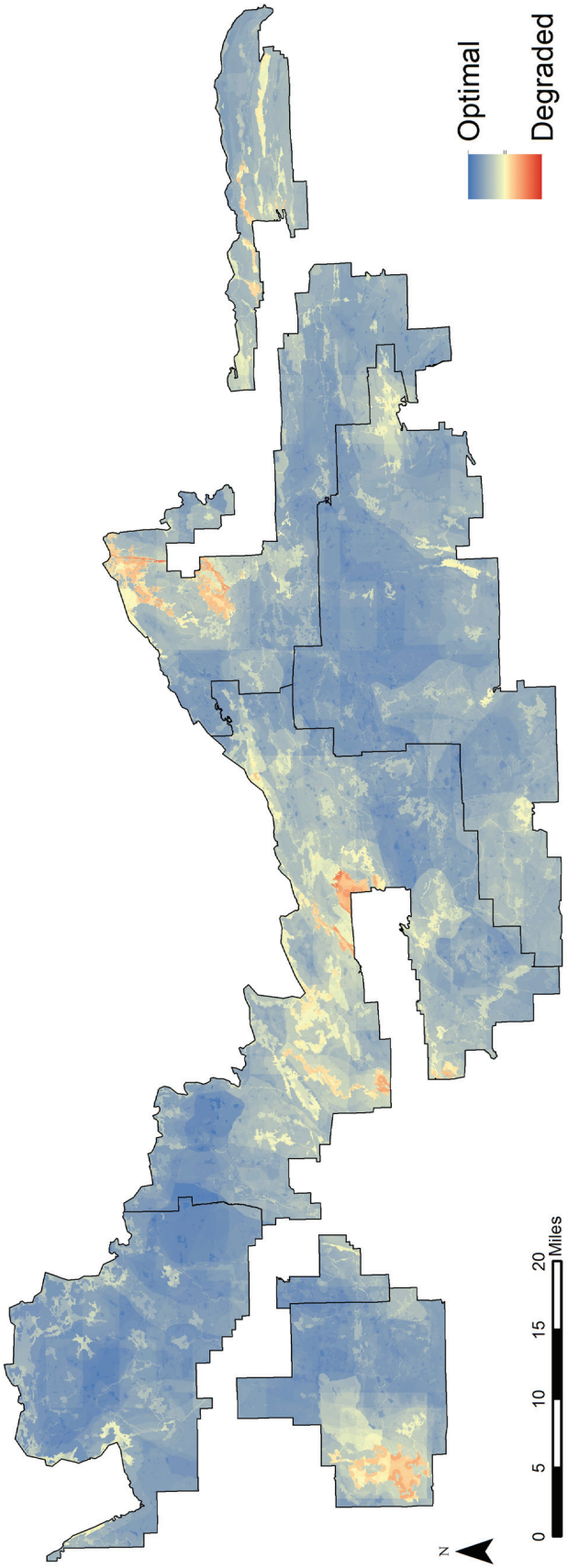

Figure 14—Map of threats to wilderness character in the BWCAW. Blue depicts optimal condition and red depicts degraded condition.

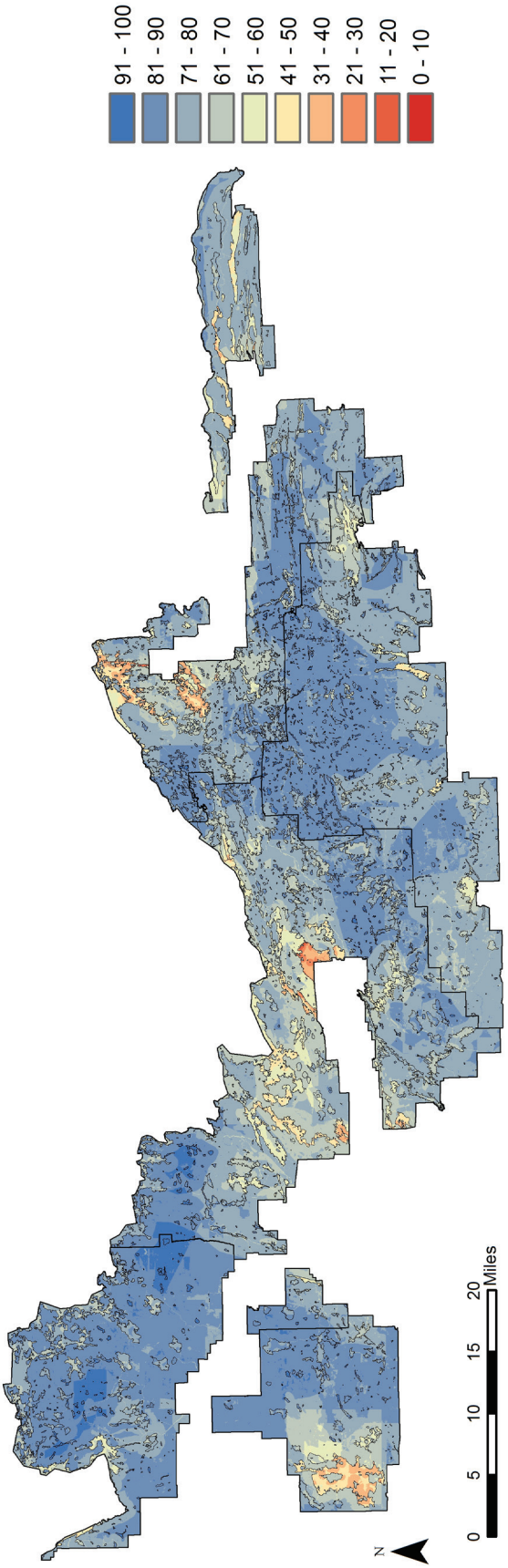

Figure 15—Map of threats to wilderness character in the BWCAW reclassed into ten equal categories. Lakes were overlayed to facilitate the discussion of threats to wilderness character. Blue depicts optimal condition and red depicts degraded condition.

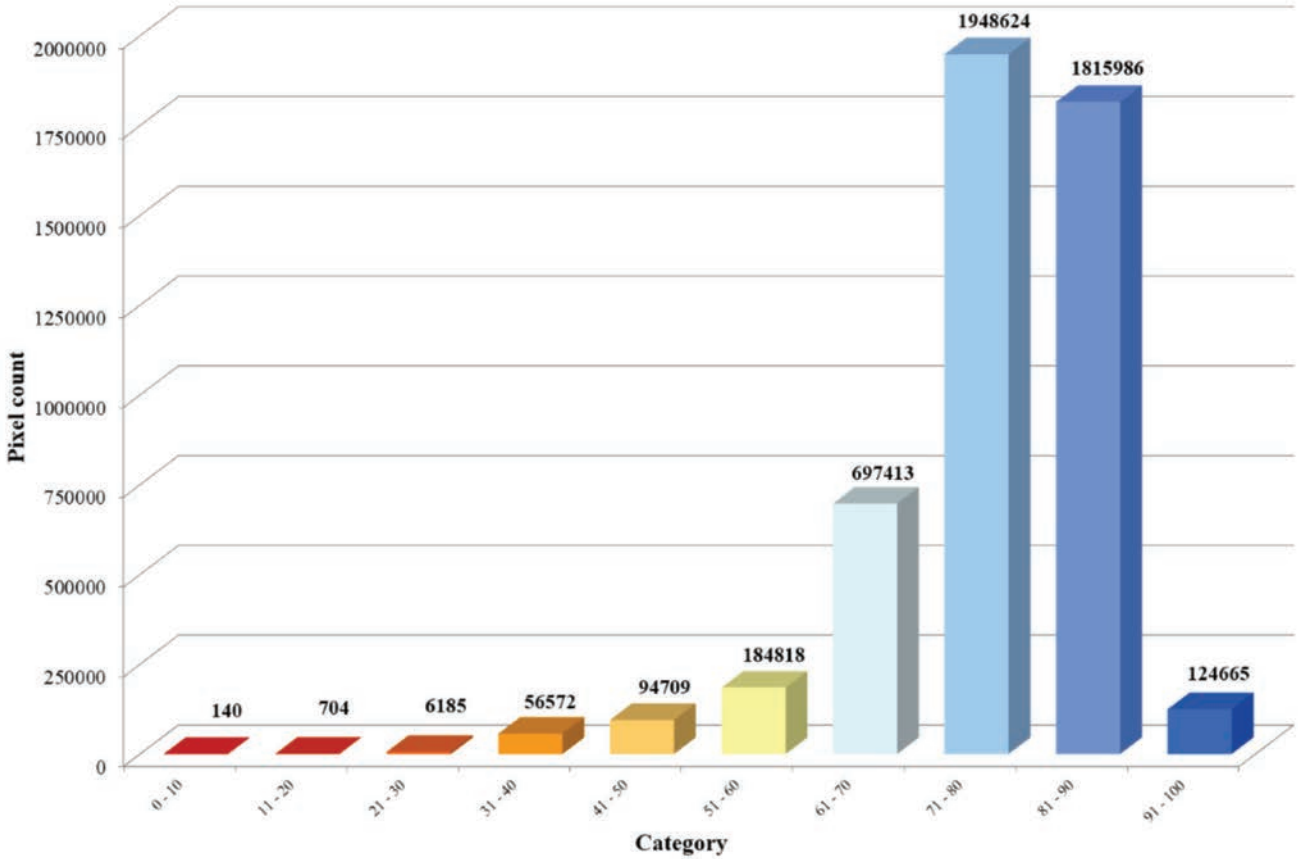

Figure 16—Histogram of the values of the map of threats to wilderness character. Blue depicts optimal condition and red depicts degraded condition.

In contrast, the highest quality categories are primarily found away from entry points and travel routes, especially in areas with fewer and smaller lakes and within pristine management areas. The three largest areas within the highest category (91–100) are found in the La Croix and western Kawishiwi districts (from west to east, these are: the area between Finger and Hustler lakes, the area east of Stuart Lake, and the area south of Crooked Lake's Thursday Bay). In addition to these larger areas, hundreds of individual lakes spread across the wilderness are also within the highest category. These lakes tend to be smaller in size and more difficult to access: many lack designated sites or maintained portages, and dozens are so small as to be unnamed. While some of these high quality individual lakes are on the western side of the BWCAW, the majority are concentrated in the center of the wilderness around the northern portion of the Tofte District. Other areas with high quality lakes include the southeastern Kawishiwi District and the northwestern Gunflint District. In general, smaller lakes and areas that are more difficult to access have fewer threats to wilderness character than larger lakes and areas near popular entry points.

Improvements

The map products presented in this report could be improved in a number ways. The maps are highly dependent on the wide range of spatial datasets that depict threats to wilderness character. Improving the data quality of the existing datasets (by improving

data accuracy or completeness) or adding datasets for the data gap measures would benefit future iterations of the maps. For example, a wider availability of improved land cover maps and a higher resolution DSM would increase the accuracy and effectiveness of the viewshed model, and thereby improve future maps of the solitude or primitive and unconfined recreation quality.

The issue of data quality also highlights the need for effective and holistic management of the SNF spatial data. Clear communication among staff, as well as with external agencies, researchers, and others working in wilderness, would allow for improvements in the quality and availability of wilderness datasets; this in turn would result in more effective and efficient wilderness stewardship. By raising awareness of data needs among field staff and encouraging the use of GPS units to record spatial data, new datasets could be created and existing datasets could be ground-truthed for accuracy or otherwise improved; it would be particularly useful, for example, to test the output of the viewshed models against observations in the field. Furthermore, regular meetings between GIS specialists and wilderness staff would ensure the preservation of institutional knowledge in the form of spatial datasets. While generally successful in these areas, increased collaboration and involvement would allow SNF staff and partner organizations to better realize how they can contribute to—and benefit from—spatial data and GIS applications.

This mapping approach also highlighted the difficulties in accounting for "value added" features of the landscape. While some features or actions may have a positive influence on wilderness character (thereby adding value), all the measures used for this mapping project quantify loss or degradation from an ideal condition. For example, if the presence of a threatened species such as Canada lynx had been used as a measure (such that areas, or pixels, where the species had been sighted were assigned a higher value), all areas without lynx sightings—even if they were not suitable habitat—would have been devalued. This issue is further complicated by features and actions that have both positive and negative impacts to wilderness character. For example, although the purpose of many BWCAW regulations is to protect natural resources (such as rules governing the use of designated campsites, the disposal of fish or food remains, the prohibition on burning trash, etc.), they also confine visitor freedom. In this case, the BWCAW rules and regulations measure quantifies these management restrictions for their negative impact to the solitude or primitive and unconfined recreation quality, without accounting for the value added to wilderness character by the preservation of the natural quality. A future improvement to this mapping approach would be to find a way to quantify features and actions that add value to wilderness character, rather than only including those that degrade wilderness character.

Final Concerns About Mapping Threats to Wilderness Character

A major concern of this work is that end users will ascribe false levels of accuracy to the map products. The tendency to attribute higher levels of reliability and precision to maps because they look accurate is common to almost all GIS analyses. The maps produced through this project are only an estimate of selected measures of wilderness

character and their spatial variability and pattern; they are not a final determination of wilderness character in the BWCAW. Underscoring this point, the maps do not portray the symbolic, intangible, spiritual, and experiential values of wilderness character that are unique to individual persons, locations, and moments. Wilderness researchers and managers have debated the merits of even attempting to quantify or map threats to wilderness character; while some emphasize the need to develop indicators that can be used to aid wilderness monitoring, management, and long-term planning (e.g., Landres 2004), others point out that quantitative analyses do not reflect important qualitative attributes of wilderness character, such as how wilderness affects each of us in different ways (e.g., Watson 2004). Although the maps do not depict all nuances of wilderness character, they still provide useful information on tangible threats. Ultimately, the maps should be viewed as a tool that wilderness stewards can use to further refine the effectiveness of their efforts to "preserv[e] the wilderness character of the area" and perpetuate the "enduring resource of wilderness" (Wilderness Act of 1964).

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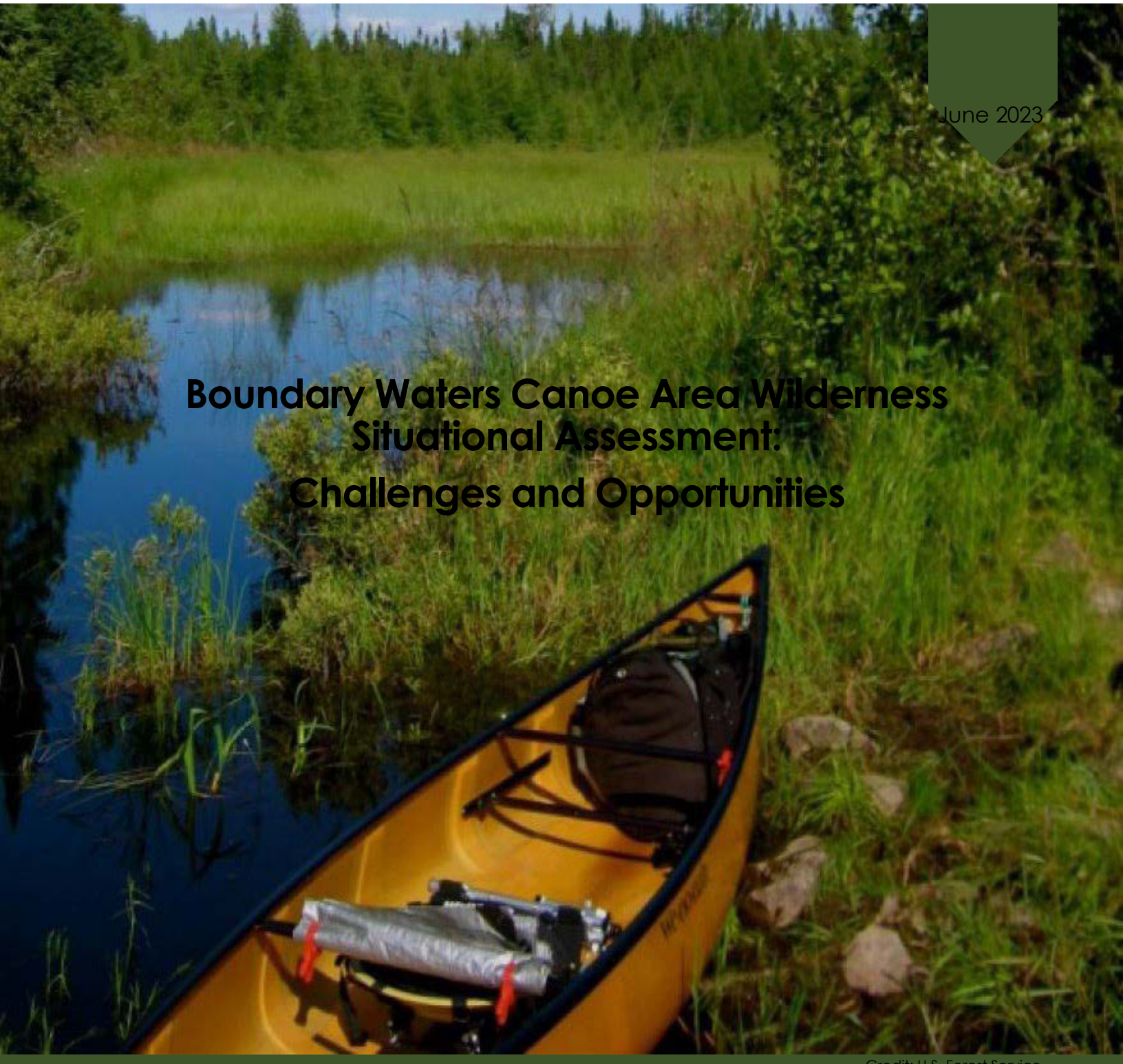

June 2023

Boundary Waters Canoe Area Wilderness Situational Assessment: Challenges and Opportunities

Credit: U.S. Forest Service

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EXHIBIT 3

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EXECUTIVE SUMMARY

In 2022, the U.S. Forest Service (Forest Service) Superior National Forest (SNF) began a new effort to engage individuals and groups with interests in recreation, advocacy, or commercial use in the Boundary Waters Canoe Area Wilderness (BWCAW or Wilderness) in exploring current issues, concerns, and possibilities for collaboration with SNF. To support this initiative, SNF asked the John S. McCain III National Center for Environmental Conflict Resolution (National Center), a program of the Morris K. Udall and Stewart L. Udall Foundation (Udall Foundation), to conduct confidential assessment discussions with a wide variety of interested individuals. The Udall Foundation is an independent, nonpartisan Federal agency of the Executive Branch.

The National Center conducted the assessment from December 2022 – May 2023. The primary goal was to assess the feasibility of SNF convening a multi-party collaborative effort to strengthen communication and collaboration surrounding BWCAW management challenges. The National Center invited more than 250 individuals to participate in this assessment effort. That outreach resulted in discussions with 100 individuals representing 66 distinct groups of cooperators, outfitters, guides, partners, visitors, academics, non-government organizations, local governments, and Federal, State, and County staff.[1] Information obtained was then analyzed for prevalent topics and themes that emerged frequently or in-depth during the discussions. Discussions explored personal views on Wilderness management, communication and education needs, and the value in establishing ongoing collaboration between SNF and interested parties.

This assessment report first highlights participant perspectives on the needs for collaboration and what that might require to be successful. It then explores challenges and opportunities to improve management of the BWCAW and ideas for how SNF might strengthen its communication, coordination, and educational efforts. Participants focused on a variety of management and communication issues, including visitor use patterns, campsite and trail maintenance, how to prevent and address “Leave No Trace” violations, permit system challenges, access to and availability of opportunities to experience the BWCAW, motorized and non-motorized use issues, current and future environmental impacts to the BWCAW, and several issues outside of the BWCAW that could cause impact inside the BWCAW. Participants pointed to the importance of SNF building strong relationships with local partners, including individual residents, communities, and Tribes. Participants also highlighted the need to update education and resource materials that encourage visitors to recreate responsibly.

The assessment concludes with overarching recommendations for SNF to consider. Most participants support the idea of purposeful and focused collaboration to increase understanding and to explore possibilities to preserve, protect, and improve a unique wilderness area they all care deeply about. Based on both participant interest and SNF’s desire to engage interested parties, the National Center recommends SNF move forward with forming a collaborative group or other forms of sustained public engagement. As a next step, the National Center will meet with the SNF leadership team to discuss the overall assessment results, recommendations on key issues, and potential actions for further engagement with interested parties.

[1] The National Center was unable to talk to Tribal Nations about the BWCAW for this assessment Representatives of Boise Forte, Fond du Lac, and Grand Portage bands were invited to participate in the assessment. SNF determined it would be best to engage those Tribes separately though other government-to-government consultations. Further information on Tribal engagement can be found in the report recommendations.

1. BACKGROUND AND ASSESSMENT OVERVIEW

The BWCAW is one of the largest, oldest, and most legislatively complex, heavily marketed, and most visited wilderness areas in the nation. Established in 1964 as a Federally designated wilderness area, the BWCAW consists of over one million acres of boreal forest in the northern third of the Superior National Forest. "The BWCAW extends nearly 150 miles along the International Boundary, adjacent to Canada's Quetico and La Verendrye Provincial Parks, is bordered on the west by Voyageurs National Park, and by Grand Portage National Monument to the east. The BWCAW contains over 1,200 miles of canoe routes, 12 hiking trails and over 2,000 designated campsites." Within the last five years (2018-2023), the BWCAW had an annual average of approximately 150,000 visitors.[2]

Complex wilderness management decisions often necessitate the need for discussion between all interested parties to ensure a greater shared understanding of management complexities. In 2022, the Superior National Forest (SNF) researched opportunities for public engagement assistance concerning BWCAW issues and contacted the National Center for Environmental Conflict Resolution (National Center) for support.

The National Center provides collaboration, consensus-building, and conflict resolution services on a range of environmental, natural, and cultural resources, Tribal, and public lands issues involving the Federal Government. In more than 20 years of operation, the National Center has provided neutral and impartial assistance on over 650 projects across the country. The facilitation, mediation, assessment, and capacity building services provided by the National Center support public and stakeholder participation in Federal programs and projects as well as engagement with agency partners while improving decision-making, increasing efficiencies through timely project implementation, improving communication and relationships, and offering more durable and implementable outcomes.[3]

The goals of the situation assessment were to:

- Learn about current issues, interests, and concerns from individuals and groups who use the BWCAW and/or those who are affected by its management.
- Gather ideas on the formation of a SNF collaborative engagement effort that would consist of a diverse representation of individuals and groups interested in the BWCAW.
- Identify key parties who would like to engage at various levels in future collaborative engagement efforts with SNF and other interested parties.
- Identify barriers to participation, and suggestions for an effective collaborative process and/or other forms of public engagement.

This assessment report explores possibilities for collaboration between SNF and interested parties on various BWCAW management challenges and identifies topics, issues, and concerns that might be addressed through collaborative engagement. This report first presents participant ideas on forming a collaborative group, what it would take to have a successful process, and the potential barriers to sustained involvement by interested parties.

The report then delves into participant views on Management of the BWCAW and touches on the

[2] See fs.usda.gov/goto/BWCAW. Additional information can be found here: BWCAW Guide-- fs.usda.gov/goto/BWCAWGuide; BWCAW Use Reports-- fs.usda.gov/goto/BWCAWUseReports.

[3] Additional information about the National Center for Environmental Conflict Resolution is available at: www.udall.gov.

following challenges and opportunities to address visitor use; campsite and trail maintenance; permits; law enforcement; motorboat use; current and future environmental impacts to the BWCAW; areas of concern outside the Wilderness boundary; and views on accessibility and inclusion.

The report then covers participant perspectives on how SNF is communicating and coordinating with partners and the public, and how efforts to educate visitors might be improved. Topics include the availability of Forest Service personnel; Forest Service communication to the public about BWCAW signage and materials; Forest Service communication and relationships with partners; visitor education materials; communication tools, and participants' preferred methods of communication with Forest Service.

Lastly, the report presents a set of National Center Recommendations for the Superior National Forest to consider.

1.1 Approach and Methods

A neutral situation assessment is a valuable tool to determine the levels of trust, willingness, and ability of parties to work together collaboratively. This type of an assessment seeks to develop an understanding of the situation from the perspectives of all stakeholders (also referred to as interested parties). One of the primary goals is to identify critical elements for the design of an effective collaborative process. An assessment can help to identify critical focus areas and an organizational structure and process that has the best chance for success. The assessment aims to ensure that the entity requesting the assessment, and other audiences of the report, have the information to understand the nuanced issues and perspectives at stake so they can work together effectively to address problems and opportunities.

The National Center staff serve as impartial facilitators and process experts when conducting any assessment. The National Center team members are not subject matter experts on the BWCAW but worked closely with the SNF staff to obtain factual background and overview information to accompany the assessment of the qualitative information derived from discussions with participants. The qualitative data obtained from assessment interviews is inherently a mix of subjective and objective input that cannot always be verified for accuracy. The National Center does not fact-check the validity or accuracy of people's real or perceived experiences, perceptions, or understandings of the assessment topic. This assessment reflects a wide range of participant perspectives, experiences, and suggestions, and the statements and quotes included herein were taken at face value. Although some participant statements may include misunderstandings of the BWCAW, or how it is managed, all participant views are useful in that they reflect peoples' real or perceived experiences and can inform SNF about issues where additional communication and public engagement may be needed.

The National Center worked collaboratively with a SNF Steering Committee (Thomas Hall, Susan Catton, Ann Schwaller, Joy Vandrie, Shannon Rische, and Ellen Bogardus-Szymaniak) to define the scale and scope of the assessment, identify a comprehensive list of potentially interested participants, design discussion questions, and determine an approach for reporting the results. A situation assessment that engages a wide range of parties who have an interest in the BWCAW was identified as the best approach to obtain SNF's desired information on critical issues for collaboration.

The National Center contacted over 250 individual participants and had discussions with 100 individuals representing 66 distinct groups of cooperators, outfitters, guides, partners, visitors, academics, local

governments and Federal, State, and County staff.[4]

Participants included:

- 6 County Government staff from 3 counties.
- 6 individuals from other Federal/ State/Canadian agencies.
- 2 Gateway Communities staff.
- 4 tourism staff from 3 tourism organizations and county tourism boards.
- 8 youth program staff from 6 organizations.
- 12 individual researchers, academics, and historians.
- 14 environmental/conservation/preservation staff from 9 different organizations.
- 19 cooperators persons from 16 cooperator organizations.
- 3 wilderness users/staff from 3 Twin Cities based Nonprofit Organizations.
- 8 outfitters/guides from 8 organizations/companies.
- 18 individual unaffiliated Boundary Water users.

One-and-a-half-hour discussion video-calls were conducted via Microsoft TEAMS between December 2022 – May 2023.[5] Due to the large number of potential participants, the National Center invited up to eight different parties to participate in each call. Discussions ranged from one to eight participants, depending on who accepted the invitations to discussion calls. A handful of individual interviews occurred to accommodate people who could not make the group interview calls.

All participants were asked the same questions from a standardized list developed by the SNF Steering Committee with guidance from the National Center. Additional follow-up questions were asked based on the unique issues raised during discussions. These follow-up questions emerged from the dialogue between the call participants and the facilitator. A list of assessment participants is included in Appendix A. The assessment discussion guide, including questions asked of participants, that was sent to participants prior to interviews is included in Appendix B. The questions were designed to gather feedback on management of the BWCAW and opportunities to improve communication, coordination, and collaboration with stakeholders and interested parties.

The following sections of this report summarize the range of responses and different perspectives shared in assessment discussions. Findings are organized by topics and themes that highlight participant understandings of issues and their suggestions to address challenges. Each challenge identified is followed by opportunities for improvement.

[4] The term Cooperator is defined as a local business that has an Agreement with the Forest Service to issue BWCAW visitor use permits at their location. They augment Forest Service office hours; create convenient permit issuing locations for the public; help the Forest Service maintain a wilderness experience through the mandatory quota permit and visitor distribution system; and increase awareness of Leave-No-Trace and Tread Lightly wilderness ethics to people visiting the BWCAW. Some Guides/Outfitters are cooperators.

[5] Throughout this report we use the term “participant(s)” to refer to those who chose to be a part of the discussion interviews.

1.2 Participant Connections to the BWCAW

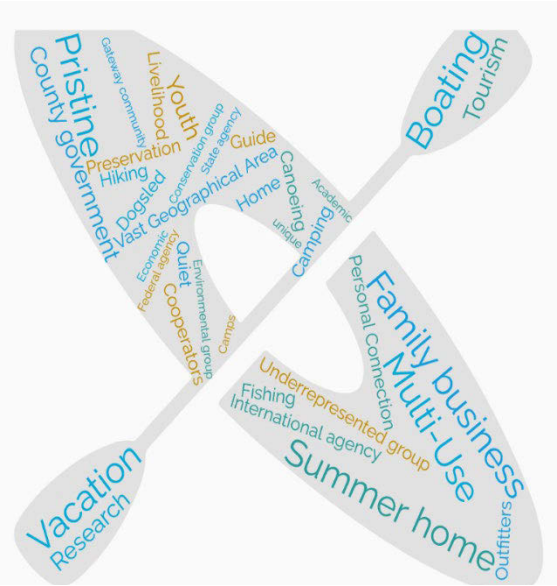

Figure 1: **Word cloud illustrating the various participant connections to the BWCAW noted by assessment participants.** *Note: Words depict the variety of organizational or personal connections and are not exhaustive. The font sizes, font types, and colors used are random and not indicative of how often the phrases were mentioned by participants.

During discussion introductions, participants were asked to articulate their connection to the BWCAW and why it matters to them. They hold a variety of interests and values that reflect why the Boundary Waters Canoe Area Wilderness is an extremely unique wilderness area. Participants noted the large geographical area of the Wilderness and emphasized that issues, needs, and interests are often specific to the Western or Eastern areas of the BWCAW.

For many, the Boundary Waters wilderness embodies both deeply personal and professional issues. Some business owners emphasized, *"It is not just a job for us. We live here.*" Others emphasized how they balance work objectives with "*personal missions, like sustainability."* Some noted they are third generation operators with family who have lived in the area before it was designated as a wilderness area.

Others spoke of the collective need for wilderness, and how the BWCAW represents *"a place to get away."* It's a *"beautiful place and a great place to disconnect from technology….* A Wilderness advocate highlighted the remarkable success of the BWCAW in remaining a unique area that can be *"visited by so many people — in a variety of capacities — and still retain an undeniable feeling of a pristine wilderness."* Another participant commented, *"I've experienced the Boundary Waters as a 'democratic wilderness.' It is used by a wide range of socio-economic classes, unlike other wilderness areas."* Figure 1 above displays the different phrases participants used to describe their connection to the BWCAW.

2. EXPLORING POSSIBILITIES FOR COLLABORATION

The primary aim of Superior National Forest (SNF) requesting the National Center to conduct this assessment was to engage a diverse cross-section of their stakeholders on the feasibility of establishing a formal collaborative group to strengthen communication surrounding Wilderness management challenges. Discussion with participants sought to identify interest and need for a collaborative group or other sustained engagement, possible barriers to participation, and suggestions for an effective process. Most participants were excited or hopeful about the idea of increased engagement with SNF staff and other parties who care about the BWCAW. Participants stated that forming a collaborative group is forward thinking and they like the idea of SNF *"shifting from a reactionary to a proactive mode."* Sustained collaborative engagement *"creates an open network of communication and provides a feedback loop to the Forest Service."*

Participants repeatedly emphasized that the purpose, goals, sideboards, and scope of any collaborative effort should be very clear. Sustained collaboration could take different forms and representation should aim to be as inclusive as possible. Most parties suggested addressing manageable issues within the BWCAW, while some thought a broader Superior National Forest focus should be considered. Participants believe a collaborative group can expand the existing Boundary Waters narrative(s) and expand understanding of those narratives. One participant said, *"More voices at the table would be good rather than everyone pointing fingers at the Forest Service. I think it would be good to hear each other."* Overall, participants were hopeful to find some common ground, with one stating, *"At the end of the day, we all want a clean Wilderness that's accessible to everyone."*

Sections 2.1 through 2.3 below detail themes heard from multiple participants. The authors developed all categorical headings.

2.1 Previous Efforts and Concerns

Some participants expressed caution about forming a collaborative and pointed to previous efforts they said had failed. They emphasized the complexity and non-trivial nature of the issues at stake. Some said certain efforts, like a State advisory management committee and an earlier mediation process, resulted in unfulfilled promises by SNF and others who were involved. Most agreed that adequate representation of interests will be challenging and reaching agreement on divisive issues may not be possible. Participants noted that issues surrounding the BWCAW have been highly contentious and that they *"fear a similar process would reopen wounds that would, again, take a long time to heal."* They also cautioned, *"It's essential to define the scope of discussion under the existing set of legislation."* Additional concerns expressed included:

- Some participants worry that a collaborative group would be a waste of time.
    - Participant Quote: "I understand the purpose of this process is different (than the 1996 mediations), but I have had so many "Stakeholder" discussion experiences that go nowhere."
- Lack of trust from the participants regarding SNF's intentions.
    - Participant Quote: "Concerned about a "Check the Box" mentality to say Forest Service ran feedback by a group but made the decision they wanted to make anyway.
    - Participant Quote: "Sometimes we worry about collecting and sharing data that is then used against us. If we are going to participate and share information, how do we know that it is being used in a way that doesn't work against us."
    - Participant Quote: "Afraid that it could be seen as a process to justify decisions that

need to go through proper stringent review, whether it be NEPA or other"

- One participant cautioned to not call it a "collaborative", suggesting that it *"leaves a bad taste in your mouth in the West."* The participant suggested "dialogue group."

2.2 What Would Make a Collaborative Process Successful?

The National Center asked participants for their views on what might make a collaborative effort by Superior National Forest successful. Facilitators framed the conversation by explaining SNF's intention to explore ways to share information between all parties in a way that might inform better management practices and actions by SNF and its partners. National Center staff clarified that although a collaborative group might provide advice, and could be a problem-solving body, the goal is not necessarily to make decisions or reach consensus. Final decision authority must rest with Forest Service on this federally designated wilderness. Participant insights highlight the need for a clear purpose and specific objectives, appropriate representation of interested parties, and potential focus groups to tackle specific challenges. The following participant thoughts are organized by categories developed by the authors.

Develop a compelling mission, purpose and vision for the process

- Be clear on what you are trying to accomplish, clarify where decision-making authority rests on various issues, and how input will be utilized in agency decision-making.
- Participant Quote: "Buying into an overall vision is critical. Vision allows you to return to something when disagreements occur. Participating people and organizations must agree to adhere to the vision and some kind of charter."
- Participant Quote: "Goals should include exchange of information and relationship building."

Establish very clear guidelines, roles, and side boards

- Clarify existing rules and regulations and how they impact current management, and expectations:
    - Participant Quote: "I want the district ranger or the assistant to be involved and engaged before I get involved in a group."
    - Participant Quote: "Creating space for truthful statements that may not be what everyone wants to hear and not stifling those voices."
    - Participant Quote: "Be respectful of everyone's time."
    - Participant Quote: "Focus on things that could be worked on... within the scope of the current legislation."

Build the agenda together and co-create focus areas

- Conduct surveys and engage members to develop (agenda topics) prior to the meetings:
    - Participant Quote: "I'd like to see the impetus coming from the Forest Service – show me that they want to cooperate."
- Include locals in the design of the process
    - Participant Quote: "It is important for the agency to implement local advice, so it can be worth people's time."

Adequate representation

- Participants are concerned about adequate representation in a collaborative group.
    - Participant Quote: "Plan for diverse involvement so you don't end up with the same

people with access privilege, power, and resources. Engage the Tribes. They are a critical voice. Need to remember this is Treaty Land. What are the Tribal interests in this, etc."

- Participant Quote: "Forest Service would have to be very conscious of types of people that they ask. Some people up there would like to open the whole thing up again, rather than keeping true to the original legislation."
- BIPOC representation should be included throughout sub-groups and should not be a separate BIPOC sub-group.
- Consider compensation of non-professionals for their time and travel expenses
    - Participant Quote: "An important question is how to get folks that aren't getting paid to participate."

Have key parties at the table to tackle specific topics

- Primary issues should address issues like campsite management; revising the visitor use permit system; noise and "Leave No Trace" violations, access areas and overcrowding, or other issues mentioned frequently by participants that are outlined above.
- Participant Quote: "Conversation topics need to be meaningful and have value (including the right people for the right topics) and have meaningful outcomes."
- Focus on the issues that can be dealt with outside of legislation (within the scope of existing legislation).
- Participant Quote: "Consider developing groups that have aligned interests, mission, methods rather than representation of vastly different perspectives."

Consider a set of focus groups or sub-committees

- Groups might be established out of a larger collaborative.
- Participant Quote: "Groups composed of interested parties can tackle key issues and then report back to the larger collaborative group."
- Participant Quote: "Specific topics will be more valuable. It's less appealing with just a large group to talk about big topics."
- Participants noted that focus groups or sub-committees might focus on different challenges or issues, including communication, motor, and non-motor boating, hiking and trails, State/Federal agencies, homeowners/ vacation rentals, and youth.

Process Participation and Commitment Needs

National Center staff asked participants what they, or their organization/agency, might need to participate in some type of collaborative process. Participants shared considerations for structural, process, and relational dynamics that would need to be addressed. They were also asked what participation concerns or barriers to participation would need to be addressed. People generally agreed on the importance of a clear reason to convene people and being considerate of the demands on peoples' schedules. They were most concerned about inclusive representation, transparency of the process, and the ability to understand how information developed during a collaborative process would be utilized by SNF, or if it is not used then explain why. The following participant thoughts are organized by categories developed by the authors.

Meeting Frequency

- Several people suggested a collaborative group needs to meet regularly to have an impact – potentially 3-4 times a year.
- Some suggested standing meetings that people can plan to attend. Others noted that ad hoc meetings may suffice.
- Participant Quote: "Meet when necessary – an ad hoc basis may make sense. Don't need to have a standing meeting."
- Participant Quote: "Be mindful of time constraints. Limit scope/time/prep. Avoid peak summer months."
- Participant Quote: "September 30 - October is ideal time for us to talk about the issues that happened in the summer."
- Participant Quote: "If limited to certain management topics and discussions, and limited in scope, then it would be easier to participate."

In-person meetings with hybrid option

- Face to face is most desirable with hybrid meeting options to accommodate vast regional participation.
- Participant Quote: "There's huge value in sitting down face to face and building the relationship, but smaller shops may not have the staff to spare to travel and attend. We're so dispersed out here – I have to drive 50 miles just to get to town. But for issues that really matter, I would make a drive."
- Participant Quote: "Maybe offer an overnight so that people can build relationships over breaks or after the meetings. Then move into hybrid meetings after relationships are built."
- Participant Quote: "Could hold the meeting out in the Wilderness. Conversations are different when you're out in the woods or paddling together."

Commitment to using the information shared

- Create a feedback loop on how things are being done or why/why not.
- Participant Quote: "There would need to be some way to understand how the information will be used in relation to a decision-making process... Have some guarantee that the information will at least be utilized. And if it's not being used, then explain why a different decision was made."

Inclusive representation

- Plan for inclusive representation of local and regionally interested parties and invite Tribal partners to participate. Tribes may choose to not participate in the collaborative but should be engaged by SNF.
- Both business owners and environmental advocates fear the other could hijack any collaborative agenda. Participants that identify with each group acknowledge that each group cares about the BWCAW, but they have a different perspective. Participation must be balanced.
- Create space for truthful statements that may not be what everyone wants to hear and not stifling those voices.

Transparency in decision making

- Provide data on how SNF is arriving at decisions.
- Participant Quote: "Often it seems like a haphazard way of coming up with these decisions (for example, reduction of permits in certain areas)."
- Have decisionmakers in the room.

Provide a strong, impartial facilitator

- Need a strong process person to keep topics on track.
- One participant suggested a BIPOC facilitator.
- Participant Quote: "[We need a facilitator] that's not in a 'green' uniform."

Other

- Clarify the relationship to FACA and determine if it will apply to the process.
- Provide official invitations to those invited to join the collaborative group so that it can be included in their job description. This ensures that the person can fully commit to a collaborative.

3. PERSPECTIVES ON BWCAW MANAGEMENT

All participants were asked to share their perspectives on the most pressing management issues, topics, and challenges within the Boundary Waters Canoe Area Wilderness. Conversations were framed to discover topics that might be addressed by SNF or through a collaborative process. This section highlights several challenges identified by participants and suggests opportunities to address those challenges.

3.1 Challenges

Participants described a variety of challenges they would like SNF to consider. They are concerned with perceived changes in visitor use patterns, campsite and trail maintenance, how to prevent and address "Leave No Trace" violations, permit system issues, access and availability of opportunities to experience the Wilderness area, motorized and non-motorized use issues, current and future environmental impacts to the BWCAW, and several issues outside the BWCAW boundary that could impact the area inside the boundary.

Visitor Use and Relationship to the BWCAW

Many participants believe the typical visitor's goals have changed over the years from seeking multiple-day trips deeper into the BWCAW, to shorter trips where they can have easy access to civilization and maintain connectivity as needed. There is a perception that many visitors are primarily utilizing the campsites as base camps (often with larger group sizes) rather than venturing further into the Wilderness and that these behaviors can lead to overcrowding on lakes that are closer to BWCAW entry points. Many felt that BWCAW visitor use increased during the COVID-19 pandemic and associated lockdowns. Participants observed that new visitors to the BWCAW during this period were less familiar with being in a wilderness area and were not well prepared, for example relying on cell phones in a place that does not always have cell phone service.

- Many participants believe these behavior and usage changes have led to overcrowding and related negative impacts effected to certain areas.
- Some participants suggested this change in visitor use means *"the wilderness ethic is*

not always adhered to."

- Some participants think the most heavily used entry point is Moose Lake.

Campsite and Trail Maintenance

Participants shared their concerns that certain campsites, portages, and trails are overused and insufficiently maintained. They attributed some of the damage to visitors and wildfires. There was general agreement among participants that in recent years (i.e., During the 2020-2022 pandemic) many visitors were not adhering to "Leave No Trace" policies, which resulted in damage to trees and campsite facilities, and more trash in parts of the BWCAW. Some speculated that it may be because "Leave No Trace" education was generally done virtually by Cooperators and Outfitters during the COVID-19 pandemic rather than in-person as in previous years. Participants highlighted the following challenges:

Leave No Trace (Examples of Campsite Misuse by Campers)

- Campers are cutting greenery and trees.
- Campers are putting things in latrines that are not allowed.
- People are burning garbage in the campfires.
- There seem to be no repercussions for visitors who abuse the BWCAW.
- Some participants felt Forest Service education videos, which are required viewing after purchasing a permit, could be improved and that SNF can take other actions to build visitor awareness (see Education section).

Campsite Management

- Campsites are not being closed to allow for regeneration.
- There is not enough firewood for campfires. People have created trails into the woods in search of firewood and it is hard to tell which trails are for the latrines or "visitor-made trails".
- Permit changes worked well to reduce impacts on campsites, but some participants said they would like to see quota added back in a few areas. Maybe not everyday increases, but more nuanced (rotating days, for example).
- Overcrowding at popular camping spots. Fewer people seem to be using the routes that are more off the beaten path that take you into more remote wilderness. It seems people aren't using these areas because the trails aren't maintained or are poorly marked.
- Bears are a big concern near the portages. People understand that adding bear-proof receptacles at camp spots may take away the "wilderness experience" but there have been too many bear incidents. Bear proof containers are cost-prohibitive for some visitors.
    - Participant Quote: "The campsites have latrines and primitive camp gear already so it wouldn't take away the wilderness values (to add bear proof containers) since there are already resources there."

Unkept Trails

- Some campsites near the Pow Wow Trail by Isabella Lake were ruined by fires and have never been repaired.
- Unkept trails can cause accessibility issues.
- Unkept trails and lack of forest maintenance has caused damage to cultural resources.
- There is very little upkeep on the trails during the winter for those who participate in winter activities in the BWCAW.

BWCAW Visitor Use Permits and the Permitting System

Access to visitor use permits and recent changes in the issuance of BWCAW permits were a prevalent theme in group discussions. Participants shared a variety of concerns and recommendations related to management of permits. Several Cooperators and Outfitters voiced concerns that permit reductions occurred without appropriate analysis of the benefits and costs of such quota reductions. Several individuals noted that SNF managers are doing a pretty good job of managing the current permit system *"with different daily entry quotas at put-in points."* Some participants expressed frustration with the speed in which permits disappear once they become available on Rec.gov. Navigating the permitting system can be technically challenging for some or for those with slow internet. Challenges surrounding permitting are outlined below:

Paddle Quota Reduction

Some Cooperators, Outfitters and other business owners feel the quota reductions was the wrong approach. They noted that the decision process was unclear and not based on statistical analysis. There is confusion around why quota reductions occurred at certain entry points and whether it was due to overuse and damage.

- Participant Quote: "Reduction of the quota permits was done in a way that didn't feel transparent or data driven."
- Participant Quote: "Fundamentally it comes down to this is public lands and reducing access to public lands should be a last resort and not a first step."
- Participant Quote: "Reducing quotas has not made a difference to impact. Intention might be good to refresh the Wilderness [Area] but [I'm] not sure it encouraged that."

Unused/Overbooking Permits

- Participants noted that permitting doesn't seem to match up with campsite use and it seems like many sites are unused.
- One Cooperator mentioned that the number of "no-show" permits was more than the canceled permits from the last year.
- Participant Quote: "The Forest Service said they were going to notify people if they had more than one permit to avoid the over-permitting issue, but not sure if it happened."
- One participant noted that perhaps the low cost of permits contributed to the overbooking and that because they are so inexpensive, people book in case they want to use them rather than only when they are sure they will.
- A few participants shared their observation that "some people are overbooking permits and then giving them away on Facebook and this really impacts local outfitters and businesses."

Flexibility with Permits

A few participants voiced frustration with their inability to adjust permits. Some of their concerns include the following:

- Only group leaders get the emails. Others in the group are not able to see the permit.
- Permits cannot be transferred to another group or individual if plans change or someone gets ill.
- Cooperators say they have asked SNF to adjust the number of people on a permit or transfer it to another person and SNF says that they are not able to do that.
- Participant Quote: "SNF reduced the permits during the fires but when cooperators have asked

them to adjust a permit, they say they can't."

- Participant Quote: "Sometimes picking up the permit is difficult, and people have to adjust their schedule to arrive earlier than their date so that they can get their permit. There is no option to get the permit online or print it out yourself."

Permitting Website Issues (Lottery vs Recreation.gov)

- Some participants stated that the previous lottery system seemed to be fairer. The lottery system allowed the outfitter/cooperator to enter in the customer's information. There was no deadline.
- Customers don't always have equal access to the internet.
    - The time release of permits is difficult and if you don't get it in the first few minutes, you are out of luck. This challenge is a large problem for those who are trying to book multiple permits or for those with lack of access to a solid internet connection.
    - Participant Quote: "[The] current system is more about who is most on the top of their technological game or who has the best internet connection. Some customers have had success but some massive failure."
- The website does not allow a visitor to book multiple permits.
    - This is especially a problem for cooperators who book multiple permits a year.
    - Certain visitor groups (for example, organizations supporting underrepresented outdoor visitors) use the BWCAW every year to bring multiple groups into the BWCAW – especially canoeing as it is a great activity for accessibility. These visitor groups are unable to book the groups that they need to book due to the difficult permitting website process. For example, the website only limits each visitor to book 3 individual trip permits for the summer, so these entities have to circumnavigate the system by requesting a school kid, parent, or other customer to use their personal email. It was specifically noted that requiring children to have an email isn't realistic.
- There is no place on the Rec.gov website to provide input.
- A participant reported his/her experience that Apple products can't be used to book permits.

General

- SNF staff hours are short and there are not many staff to assist in addressing permitting. As a result, people prefer to go to outfitters where they can pick up their permits at hours convenient to them and can ask questions while they are there.
- A cooperator shared that although some find that it is easier to get a permit from the outfitters, *"the outfitters don't get paid to administer permits and they administer most of the permits."*
- Participant Quote: "Cooperators write our own permits for cross country skiing and ice fishing – those of us who use it year-round are not able to self-regulate to the area's benefit."

Law Enforcement

Some participants from BWCAW user groups and other participants felt there is insufficient SNF personnel in the BWCAW to assist visitors and enforce rules. They noted that campsites --and campers -- are sometimes not in compliance with regulations.

- Some participants were concerned that DNR conservation officers are limited in their ability to enforce violations. They said SNF Law Enforcement Officers (LEOs) have less restrictions than

conservation officers due to their authorities. Typically, the conservation officers will give their information to the SNF law enforcement officers to implement.

- State agency personnel who participated in the assessment often spoke from an enforcement-based perspective. These participants complimented interagency coordination and communication with SNF on challenges like wildfires and only highlighted a few areas for improvement. A participant shared, *"it seems like on the law enforcement side, Forest Service hands might be tied at times in terms of enforcement. MN DNR seems to have a little more flexibility. It's good cooperation but its ultimately the State DNR that does most of the ticket writing, etc."*

Motorboat Use in the Wilderness

Several participants emphasized their dislike for the current level of motorboat use and commercial towboats in the BWCAW as they find it has changed the use patterns and impacted peoples' experience of the Wilderness. Some participants shared strong concerns, including one who was a part of the legislation discussions surrounding motorboats in the BWCAW, *"When we agreed to 25 hp motors on the Moose Lake Chain and parts of Basswood, the Senate staff were told that commercial towboats could not operate with only 25 hp (Because they previously used unlimited hp motors. But they found they could operate with 25 hp). Now, towboats in those areas are half the traffic. Also, a single motor permit allows four boats I have no idea how that happened but maybe the reasoning was that the canoe permits allow four boats. So those permits are widely shared."*

Other participants, like cooperators who rely on towboats as part of their livelihood, are happy with current towboat and mechanical boat use management. Participants pointed out that some waterways are difficult for canoes to navigate across, and the towboats assist those visitors. They also suggested towboats could assist in dispersing visitors throughout the BWCAW from various entry points.

Perspectives on Motorboats

- Some voiced strong concerns on motorboat use because it is not "primitive" and does not offer "solitude."
- Participant Quote: "Motorboats are sometimes used at night, which is during hours that should be noise free and motorboats can be scary for canoers."
- Seagull Lake has horsepower limits and restricted motorboat areas, but a participant noted that "*people are violating this rule and [it appears that] Forest Service is not enforcing it."*
- A participant shared that two motorboats agreeing to meet in one place is a violation of their permits for how many motorboats are allowed on a permit.
- Participant Quote: "There are very small windows and areas in the BWCAW where you can't hear motors. In some of the areas, motorboat use starts before dawn and continues until after dusk. Willing to compromise but can this be reduced some. I'm not a purist but noise is currently too much."
- Others mentioned that day use motorboat permits are a very hot commodity for use in the Fall and people buy those out very quickly. Cooperators have been telling SNF that they need to get a handle on this so it's a more even playing field and people are not gaming the system.
- Some participants are very happy with the current management of all motor use in the BWCAW and "don't want any changes."
- Participant Quote: "[I] believe we do need to balance the different types of users. [It's] dangerous to be too exclusive and only cater to hard core non-motor users."

Additional Perspectives on Commercial Towboats

- Participants mentioned that litigation from Wilderness Watch is impacting commercial towboat issues.
    - Participant Quote: "As a commercial business it's hard to put energy into a towboat business when threat of NEPA and SNF decisions may reduce towboat use further."
- There are issues with towboats surrounding the 1978 law. Exempt use that was counted is not counted.
- Some business owners emphasized that existing Towboat special use permits are not transferring to new owners with the sale of a business, and this has major impacts on the viability and value of those operations.

Current and Future Environmental Impacts to the BWCAW

Participants mentioned that SNF could have a more proactive and resilient response to climate change, especially around fire management practices.

- Blowdown: Some participants explained that there has been an issue in the BWCAW with excessive blowdown of dead wood.
- Others raised concerns about how best to manage all the potential deadwood fuel in the BWCAW. A participant said that historically there have been prescribed burns, including the burning of dead wood in the BWCAW.
- Participant Quote: "Prescribed Burning should be allowed to mimic Aboriginal burning… in the way that was used in pre-European times for enhancement of tree growth on important campsite areas and for wildlife and vegetation enhancement. I recognize that the impetus for this may have to originate with the Tribes. The Wilderness Act definition is historically inaccurate: 'where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.' Obviously as recent studies have shown, there was a lot of forest management by the early inhabitants."
- Other environmental problems noted include wild rice depletion, loss of earthworms, wildfire, and changes in moose populations.
- Transport of invasive species: One participant expressed concerns that boat use across the region could result in the transport of invasive species. *"I worry about transport of invasive species - the boats should be docked in the area that it is being used. For example, if a boat comes from Ely to a different lake, then maybe it might bring an invasive species from that lake. It would be good to use the boats that are located at the lakes they typically use to avoid possible transport of invasive species."*

Areas of Concern Outside the Wilderness Area Boundary

Although the scope of this assessment focused on areas within the BWCAW, several participants raised issues and concerns about areas adjacent to the BWCAW that impact the Wilderness area. Diverse parties, including business owners, environmental advocates, and visitors who are unaffiliated with any specific organization, are concerned about mining and its potential impacts on water quality. Other participants mentioned that protecting the land at the edge of the BWCAW is important.

- Participant Quote: "The copper mining is an issue to me, the water quality, and the health of the watershed. It is a very serious and threatening situation. I don't see how the mining can be done safely."

- Participant Quote: "The BWCAW should be protected from mining and from the aftereffects like contaminated waters."
- Participant Quote: "I'm not necessarily 100% opposed to mining but would want to have safeguards to maintain water quality and preservation of wilderness."
- State to Federal Land Exchanges within the BWCAW are another topic that may warrant further discussion and collaborative action.
- Participant Quote: "Land exchanges are important although the players keep changing because of the district rangers and leadership change over."

Accessibility and Inclusion

Several male and female participants who identified as Black, Indigenous, and People of Color (BIPOC) and/or LBGTQIA emphasized that underrepresented groups lack exposure to learning about how to camp, canoe, or generally recreate in the BWCAW. BIPOC and other underrepresented individuals often lack the resources or access to experience national parks and wilderness areas. The participants did not voice specific criticisms with the management of the BWCAW but suggested greater opportunities for education and access.

- Equity issues can be impacted by the inability to secure permits and by permits that go unused by more affluent visitors. A participant noted, "*permits are wasted by those who can afford it."*
- Some participants discussed stewardship and have mentioned that BIPOC communities have a negative interpretation of unpaid work outdoors.
- Some participants noted that what is often considered to be "appropriate" use of the Wilderness (being quiet, recreation focused, non-motorized vehicles, being unplugged from electronics) is connected to a white wilderness ethic that privileges certain types of uses over others such as activities that create noise and cultural and spiritual experiences of wilderness.

3.2 Opportunities

Participants outlined a variety of recommendations for SNF to consider. Participant suggestions vary in scale and scope and may not always be feasible. Some suggestions may be prohibited by the laws of the Wilderness Act of 1964 and the 1978 Act as well as the Forest Plan. Other suggestions may be quite attainable. All suggestions reflect the real or perceived experiences of participants and are of interest to the SNF as it communicates and coordinates with various parties about the BWCAW. Participant suggestions to improve the management of the BWCAW are listed below:

Opportunities Surrounding Visitor Use and Relationship to the Wilderness

- Encourage visitors to go further into the woods by providing them with maps of routes to explore more remote areas.
- Encourage visitors to visit the Canadian side of the BWCAW. They have the carrying capacity to accept more visitors and maintain the wilderness experience.
- Collectively work on developing travel routes in the BWCAW (difficult, intermediate, beginner) like systems that exist for skiing and mountain biking.
- Pristine Management Areas should be managed by providing more guidance, outlining limitations, and adding certain restrictions to trailhead and entry-point lakes to encourage people to spread out more.

Ideas to Improve Campsites and Trails

- Participants suggested SNF develop more guidance and education on alternative routes, and

ensure trails and campsites are cleared for easy access.

- Close campsites that are facing significant impact and open new ones to help with overuse.
    - Participant Quote: "There is something like 2,000 designated campsites. When they get to a certain point of use. they should be regenerated."
- Add pictures and descriptions of campsites for visitors to review when making reservations.
    - For example, one story mentioned a group ending up at a campsite that wasn't accessible for an individual in their group. There were tree roots that the person couldn't see in their peripheral vision. They also noticed that their campsite was too small for their group when they arrived at the site. This group ended up taking photos of the campsites for their own use to know which campsites would be best for their group.
- Increase staff presence on the ground to give different routes around main corridors. Primitive management areas are not used very often because people don't know about them. If there was more maintenance on those portages, then maybe people would use them.
- People noticed that the issues they see on the United States' side of the BWCAW are more prevalent than on the Canadian side of the BWCAW. It could be helpful to learn best practices from Canada.
- Some participants suggested providing bear trash receptacles and bear lockers at sites. A few mentioned that asking people to bring their own bearproof container can be cost prohibitive.
- SNF could encourage and set up "clean up" or "restoration" focused trips and ensure they are funded.
- Continue to develop recreation experiences outside the BWCA for people to have other opportunities outside wilderness.

Opportunities to Improve Permitting

Participants noted that there are opportunities for SNF to be more nuanced in the visitor use permitting system. Several people said any reductions and changes in BWCAW permits should be based on data points to the extent possible. Some participants suggested restricting where people can stay on certain nights and for how many nights, rather than reducing quotas overall. And encouraging visitors to travel to different places on certain days. Participants provided the following recommendations:

<u>Visitor Permit Use</u>

- Visitors should have the option for different types of permits to encourage more visitors to explore further into the BWCAW.
    - Incentivize different times of travel and different travel routes.
    - Require visitors to get to a certain area by a certain date and ensure they can't stay on certain lakes for more than a certain amount of time.
- Incentivize people to fill out the surveys to get better information on where the trips are occurring so that SNF can get better data for visitor use permitting.
- Participant Quote: "Promote more hiking in the BW to reduce battling for canoe permits. It seems people are unaware of the hiking opportunities and the hiking trails are bare."
- Participant Quote "Promote other forest-based recreation opportunities in the Superior and in other State Parks and surrounding areas that are outside the Wilderness area. There are a lot of nearby places to visit that don't have the same restrictions as BWCAW and could help reduce

overcrowding".

- Lead a study to monitor visitors and what they want out of the BWCAW. Ask: who are we collectively trying to serve, and what do people want? Some people just want to relax and want all the rewards without the work of paddling everywhere.

Visitor Use Permit Quotas

- Participant Quote: "SNF should use statistical analysis and science to make better decisions about quotas. Provide statistical/data evidence to show how and why permits should be reduced. Need to show the data and show the impacts and results in 2022. Should be transparent and open."
- Adjust quotas to the types of trips people want and increase education about those opportunities.
    - Assess the different usage across the system – for example, those going in for a day or two versus those moving through. The permit doesn't assess those kinds of questions about use.
    - Consider a permitting system that requires people on multi-day permits to move from one site to another over a certain number of days to prevent overcrowding near entry points.
- Partner with people who use the BWCAW every day or cooperators/outfitters to improve permitting and managing issues.
- Publish SNF Visitor Data of Permits at the end of the year. This information helps cooperators and other businesses plan for the following year. Information to be collected and distributed should include:
    - Number of permits per entry point.
    - Permit holder names.
    - How permits were issued.
    - How many permits were cancelled.

Permit Reservation System Website

- Enable Rec.gov to show when there are no shows or cancelations in real time, so that people nearby can obtain unused permits.
- Participant Quote: "Develop a permits specific website for only BWCAW; Recreation.gov is not good and is not living up to their government contract."
- Visitors to the BWCAW should be able to receive their permit and materials online.
    - Participant Quote: "People should be able to get their permits online because stores are often closed, and people often arrive after work hours. MN DNR has a good system for fishing permits."
- Allow permit applicants to pre-enter permit information so that when the release happens, they can just press submit.
- To free unused permits up for others, people who book permits at Recreation.gov should be given a warning and reminder to commit or cancel a certain number of weeks or days prior to their permit date.
    - Create a text messaging system to send to permitters to confirm if they will be using their permit. For example, "Are you using your permit? Text Yes or No."

Visitor Use Permit Fee

- Consider raising the permit fees and making it non-refundable to prevent stockpiling or hoarding of reservations.
- Penalize those for not using the permits.

Visitor Use Permit Reservation Access

- Permitting should be done on a rolling basis instead of opening them all on one day to prevent people from taking all the permits.
- Hold Day Use permits for elderly people and people with disabilities.
- Allow groups that serve underrepresented youth and adults to enter a lottery for non-commercial outfitters.
- Hold a certain number of permits for people located in nearby zip codes.

Suggestions for Law Enforcement in the BWCAW

- Need visible enforcement by SNF staff in the BWCAW.
- Increase coordination between conservation law officers and law enforcement officers and clarify roles.
- Consider a charge for rescue in the BWCAW to encourage people to be prepared.
- Consider real penalties associated with any damage to the BWCAW. Enforce it and create examples of "Leave No Trace" violators.
- Participant Quote: "Need more boots on the ground education and enforcement. Checking permits etc. I think Superior National Forest has done a good job educating people through ranger stations and videos, but the guides and cooperators have to do their part."
- Participant Quote: "Forest Service needs to take it a step further and have stronger consequences for "Leave No Trace" violations. Clearly list the things visitors should not do, for example, 'prohibitive behaviors' like leaving gear or cutting down live trees."

Opportunities to Address Motorboat Use Challenges

- Continue to allow commercial towboats to help people cross bigger lakes safely.
- Provide safety education for visitors who are using non-motorized, non-mechanized, non- canoe equipment such as kayak and Stand-Up Paddle Board users.
- Only allow boats that are fuel efficient. Yellowstone National Park did this with snowmobiles and a participant said it worked to reduce noise and contamination of resources.
- Increase signage throughout the BWCAW that indicates where motor and non-motorized boat use is allowed.
- Restrict motorboats to designated hours. If there are already designated hours, there should be greater education and enforcement as several participants said motorboats are being used at night.
- A participant suggested that a collaborative group could generate ideas for management of motorboats – "For example, there may be some kind of a temporal zoning idea that would allow some motor-free times on the motorized routes."

Opportunities to Decrease Environmental Impacts

- Incorporate Tribal knowledge into fire management protocols and implementation.
- Initiate prescribed burns and burning of blowdown wood.

- Develop invasive species protocol and eradication.
- Fund more Forest Service soil scientists and other science-based resources out in the field. Scientists should be looking at water quality around campsites, plant collecting, moose research, etc.

Opportunities Outside the BWCAW

- Provide clear guidance on how to manage lands adjacent to the BWCAW.
- Prohibit mining in the BWCAW.
- Survey how many jobs would be created for mining and how many people would take the mining jobs in the surrounding area. Compare that to other factors.
- Participant Quote: "Of course there would be jobs for construction and many fewer for operations and the management types would do well. And I understand the argument that tourist industry jobs can be seasonal and may not pay very well. But I'm skeptical. I'd love to see a house-to-house survey of Ely and surrounds about how many current residents would actually expect to work at a new mine, for example. Of course, there is the argument that the economy of the town needs more people with jobs, but the counter is that the pristine environment is the biggest asset to the local economy. And there is research to support that."

Opportunities to Improve Accessibility and Inclusivity

- SNF could partner with organizations that provide opportunities to BIPOC individuals to share information about how to camp, canoe, and recreate in the BWCAW for those who do not have that experience.
- SNF should specifically hold a certain number of permits for individuals from BIPOC communities and other underrepresented groups.
- Participant Quote: "Be wary of only holding permits for LGBTQ communities since it could still exclude BIPOC communities."
- SNF staff could offer permitting assistance for those who do not have access to the internet or who have trouble acquiring a permit.
- Provide bilingual materials for visitors in the BWCAW.
- Participant Quote: "Forest Service staff, especially backcountry rangers, should take a cultural competency/humility course."
- Hire BIPOC staff and increase visibility of staff in the BWCAW.
- Participant Quote: "Diversify the staff at the Forest Service that work within the BWCAW. It would be helpful to make the USAJobs process easier to do this or identify the barriers and help close the gaps."
- Fund BIPOC run programming.
- Offer transportation assistance to the BWCAW for those who do not have access to a vehicle.

4. COMMUNICATION AND EDUCATION

SNF is interested in improving communication, coordination, and education with partners and visitors. As part of this assessment, National Center staff asked participants to describe any examples of coordination or communication efforts with the SNF on BWCAW issues that worked well in the past or any that did not work well. This section of the report chronicles those participant insights into how SNF might strengthen its communication with others.

4.1 Challenges

Many participants highlighted the importance of having effective interpersonal relationships with Forest Service Rangers and other SNF staff. People who live near the Forest highlighted the clarity of communication around fire management, and that State and Local partners value the strong inter-agency coordination. Regular and transparent communication around management decisions is particularly important to cooperators, outfitters and others who live in Forest gateway communities. Participants noted that some communication breakdowns are related to availability of SNF personnel to address the challenges people face in wilderness areas. Other communication challenges stemmed from unclear messaging to the public, lack of information given to SNF partners, and poor signage in the BWCAW. Related challenges are outlined below:

Availability of Forest Service Personnel

- Visitors are unclear who to contact at the SNF and for what service. Some participants said there is very little information online to direct them to the right point of contact.
- Some visitors don't know who to call to get information or how to get help regarding a reservation. Sometimes they will be sent to Recreation.gov or the Ranger Station and then will get different answers.
    - Participant Quote: "Communication with individual rangers can be good depending on the ranger. As things go up the Forest Service chain, things become opaquer and the more political the decision-making appears to be."

Forest Service Communication with the Public about the BWCAW

- Some participants felt that the Forest Service has been conveying unclear messaging to the public, such as the BWCAW is "overrun," it is "difficult to visit," or when natural disasters happen that the "*BWCAW is burned down*." They believe this is changing public perceptions and encouraging some visitors not to visit. A few individuals spoke about the need for more effective narratives about the BWCAW.
- Participant Quote: "During the fire year, there was an unprecedented closure of the Boundary Waters. Messaging was mishandled by the Forest Service causing collateral damage. The Boundary Waters Public Relations team conveyed a narrative that the Boundary Waters had burned down. This impacted visitor numbers."
- Participant Quote: "Forest Service also messages that the BWCAW is overrun, and this is changing public perceptions. The BWCAW is different in each region and while some areas may be overcrowded, other regions are not. This may discourage people from visiting the BWCAW."

BWCAW Signage and Materials

- Information on the BWCAW is not clear or specific enough and should be more accessible.
- Some participants suggested SNF increase campsite and trail signage throughout the BWCAW.
- Other participants felt that too many signs take away from the pristine nature of the experience, and the lack of signs in wilderness is different and special.
- Participant Quote: "Current signage emphasizes recreation as the main purpose of the area and focuses on western centric values."
- Participant Quote: "The Forest Service has the most bureaucratic process to communicate things like human waste and they need someone who can develop

messages that are impactful to people."

- Maps are hard to read, and visitors don't always know which areas are private lands vs public lands.
- Information on Recreation.Gov are only in English – no other language is available.
- Participant Quote: "The website is mostly communicated to a general American user. There is not better messaging for people who are accessing the places more frequently. Maybe there's two websites for people who are coming to visit or people who live in the area."

Forest Service Communication with Partners

- Permit reductions were not communicated in advance.
- Those who are holding guide cards but are not outfitters do not get the same amount of communication as the outfitters and cooperators.
- There is a need for better communication with search and rescue to be able to evacuate people and be efficient.
    - Participant Quote: "We've had a significant increase of false alarms from spot locators because they're rolling around in backpacks. Spot locators are being given out by cooperators. Our search and rescue folks are volunteers, and it takes a lot of time to find the people and we have to wait for permission to go into the BWCAW. However, some of the spot locators have texting capabilities so that we can figure out if we need to go help people or if it is a mistake."
- Several cooperators, guides, and outfitters said there is not enough SNF communication with them outside of the scheduled cooperator meetings.
- Participant Quote: "Cooperators have great information on pinch points in the BW and the travel patterns. When visitors return to the cooperators, they tell them about what they did and what they saw. They are not telling the Forest Service these things."
- Participant Quote: "They [cooperators, outfitters, and guides] are a wealth of knowledge on what people are doing in the Wilderness and their experiences. The Forest Service only sees people before their trips and not usually during or after their trips."
- Participant Quote: "We want to be seen as a resource, but the Forest Service continues to view us as having an economic agenda. A smaller group of cooperators could assist in helping to manage the different types of users for example."
- Participant Quote: "A trail was taken out and we told the Forest Service that we could try and work on it. We did about 6 miles of it. But the Forest Service changed their mind and did not want us to assist anymore. One of our attorneys pointed out that they would have to change their plan and then they said we could do it. Things have been better now through building trust."

Visitor Education Challenges

Participants suggested that there is insufficient education for the general visitor and groups who are less familiar or unfamiliar with the low impact requirements of the Wilderness area. Participants encouraged more learning for everyone in the BWCAW, noting *"we need to have some ethics to protect wild wisdom and direct learning from nature."* Many felt visitors lack sufficient education about "Leave No Trace" policies and other rules.

- Cooperators have noticed that visitors lack attention to the educational videos. Some said the videos are confusing and do not include the number one rule violation – "*no glass bottles or*

cans in the BWCAW."

- Since videos are only sent to the trip leaders, only the trip leaders are required to watch the videos. Others on the trips most likely do not receive sufficient education because they do not watch the video segments. However, a participant noted that the rules are on the paper permits. There is some tension around how visitors should be educated.
- Participant Quote: "In the past it was kind of like the video police... Went from accusations of outfitters and cooperators having to show people, even if tiring, to the opposite extreme. We are worried about people making these decisions on their own. Product is not the same and user is not the same. Guests are coming for shorter times than they used to and not moving so much. Want easy access and one base camp. The easy fix by Forest Service was to cut the permits but that is not the answer to address this 'soft laziness' by the public."
- Other participants emphasized that visitors need more safety guidance about navigation and route finding. One participant stated that, "*There was a boy scout group that needed rescuing by others using the BWCAW because they didn't know how to traverse the BWCAW lakes well*."

4.2 Communication and Education Opportunities

Participants pointed to the importance of building relationships with local communities and Tribes. They emphasized communication that is more intentional than generic such as only informing the Tribes through general newsletters and emails. Participants suggested how SNF might improve education challenges in the BWCAW. They recommended SNF encourage visitors to uphold "Leave No Trace" policies and create new education and resource materials for recreating in the BWCAW. Participant suggestions are outlined below.

Build Better Relationships and Work Strategically with BWCAW Partners

- Establish a SNF liaison with certain groups to relay critical information. Utilize the groups to share the information shared by SNF with their respective networks.
- Forest Service staff should be out in the field talking to partners more to observe and understand the needs of the BWCAW.
- Forest Service staff would get more buy-in from outfitters and cooperators if these entities were included in decision-making.
- Participant Quote: "One of the district rangers came up to my cabin and just sat and chatted with me about my thoughts on the BWCAW."
- Collaborate with Heart of the Continent group on research and management workshops.
- Host a research and management symposium every two or three years.
- Host a summit on the BWCAW every year to discuss what is or isn't working.
- Identify more informal collaboration opportunities with partners.
- Suggest outfitters/cooperators/guides to keep their websites up to date.
    - For example, one participant called an outfitter for a canoe and found out on the phone that they don't do canoe rentals anymore. The website was not up to date.
- Establish a "Friends' group." A "Friends group" is a partnership made up of a nonprofit Friends organization and a Forest. The Friends group and Forest share a primary mission and objective.
- Partner with gateway communities to provide an education and feedback loop for SNF.
- Encourage partnerships between SNF and backcountry search and rescue groups to better coordinate on incidents.

Communicate Earlier and More Often

- Even if the information is sensitive, consider holding an informal meeting with key parties.
    - Participant Quote: "Cooperators want to be in the loop."
- Send out surveys to gather information.
- Outfitters, guides, and cooperators would like to be notified before the general public when the BWCAW is being closed.
- During the Spring/Fall cooperator meetings, SNF should be able to provide information directly or have a feedback loop if they must go to FS headquarters for answers.
- Have a decision tree or communication plan that disseminates different communication based on what the information is.
- Co-create messaging with the local communities.
- Emails that are sent about regular communication should draw attention to what is important to read.

Effective Communication Tools

- Host a specific BWCAW website or forum that is monitored by SNF with information on what visitors need to know, where to go, tips, etc.
- Have local IT help available for website issues.
- Publish up-to-date reports on closures, fishing, ice, water levels, etc.
- Publish an updated organizational chart on the website and delineate who to contact at the Forest Service for what type of topics.
- Develop a blog or website that shows where things are happening at campsites in real time.
- Create a map of the system by lake or river where visitors can put it in comments about the routes.
- Use social media to address usage challenges:
    - Participant Quote: "Highlight a lake on social media to advertise other areas to visit, but don't give away all the secrets."

"Leave No Trace" Considerations

- Enhance education on "Leave No Trace" policies using a variety of communication methods.
- Participant Quote: "When you have to do it by hand it is more impactful. The online form that the outfitter is doing for you can be very hands off. There is something about having group leaders have to physically sign off and check the boxes. The backside of a current permit has many of these things, but they often get checked by someone else."
- Request visitors to sign off on an agreement that states if you are found in violation of a rule that the visitor forfeits the permit or the right to future permits for a certain amount of time. All trip leaders and alternates would need to sign for their group.
- Partner with "Keep it Clean," which was started by Lake of the Woods for the winter.
- Solicit more commitment from group leaders to encourage people to take care of the BWCAW like collecting cans.

Wilderness Education and Resource Materials

- Create additional education materials targeted for different types of visitors: the casual visitor, non-motorized boaters, stand-up paddlers, kayakers, canoers, etc.
- Develop interpretation materials and signage that promotes the idea of wilderness that is

deeper than recreation (for example, cultural uses, more integrative understanding of the sacredness of these lands and waters, and highlights the area's historical, cultural and religious/spiritual significance to Anishinaabe people).

- Outfitters, cooperators and guides need to work together to do more to help educate clients such as hosting a forum.
- Develop maps that can outline a variety of routes and areas for campers, hikers, and canoers to explore.
- Develop more accurate fish maps.
- Produce higher quality and more up-to-date videos and online material; create more creative messaging to reach and capture the attention of younger generations of users who might be creating the most impact and using the BWCAW more.
- Require a quiz for repeat visitors instead of requiring them to watch the education video to acquire a permit.
- The Forest Service should offer visitors a certificate of completion that confirms they have watched the education videos.
- Provide education workshops with BIPOC and other underrepresented communities (day and evening programming in the Twin Cities, for example, to reach those who work 9-5 jobs).
- Participant Quote: "Learning different ways of knowing and being in wilderness. There is a perceived way of white western male of wilderness and there is a lot of opportunities to learn from BIPOC and indigenous ways of wilderness and wilderness management."
- Provide training or access to training information on forest fire response for cooperators, guides, and outfitters.

4.3 Examples of Effective Communication

Participants were asked to share examples of good coordination and communication efforts they had experienced with the Forest Service on BWCAW issues. Many of these examples surrounded natural disaster protocols. Local, State, and Federal agencies spoke about effective interagency communication and coordination during fires and other natural disasters. An agency participant stated that, *"good communication is working through the "Heart of the Continent" meetings."* Other participants shared the following:

- People emphasized good relationships with local SNF staff, including those who work in the BWCAW.
    - Participant Quote: "Consistency of staff in the East Zone is very good; people are approachable."
    - Participant Quote: "Overall, our communication with Forest Service has been really good and that's why the reduction in permits was a surprise."
- Cooperators noted that the organized cooperator meetings generally work well for getting a lot of information. They do not always allow time to delve into specifics or get non-agenda questions answered.
    - Participant Quote: "Cooperator meetings are helpful, but sometimes (there is) too much detail on particular issues like fires."
- Communication during forest fires and other natural disasters was cited as a positive example by many.

- During the fires, the Forest Service communicated well with the public by holding press conferences and providing information on where the closures occurred in the BWCAW.
    - Participant Quote: "There was a tornado that hit a trail and the Forest Service went to assess it. We stayed in contact with the Forest Service and by mid-May the trail was ready to go. The trail was in bad shape before that. It was only because we stayed in good contact and worked collaboratively."
    - Participant Quote: "If the road is blocked where I am, there is no way out. The Forest Service came out and told us how to get out, gave us sandbags, told us how to communicate, and said the worst thing that would happen would be that we would have to kayak up the river and they would pick us up via helicopter."

Preferred Methods of Communication

As part of the discussions around what is working and what could be improved, participants were asked about preferred ways to receive and provide information to SNF about the BWCAW. The majority said e-mail was ideal for most issues since it provided a way to keep track of communications. Phone calls are appreciated for urgent matters, and in-person visits and meetings are appropriate for certain topics. Table 1 below summarizes participants' preferred methods of communication for different situations.

Table 1: Preferred Methods of Communication

Type of Communication	When This Type of Communication is Best
E-Mail	For routine information – numerous participants noted that it's the most convenient way to track and reference past correspondence.
Phone Call	For communication with cooperators, outfitters, guides, and lodges during urgent natural disasters such as the recent fire ban. For complex or sensitive information.
Text Messages	For emergency information.
Newsletters	To highlight current initiatives and opportunities to engage in wilderness planning/policy/management.
Social Media (for example: Facebook, Instagram)	For information sharing.
Face-to-Face	For relationship building. When topics are sensitive.
Meetings	For relationship building. For information sharing during the winter and spring to help plan out the next year and learn from the prior year.
Postcard	For reminders (example: outfitters mentioned that the postcard reminder about their guide report being due is helpful.)

5. NATIONAL CENTER RECOMMENDATIONS

The following section provides some overarching and specific recommended actions for the Superior National Forest team to consider. The National Center recommends the SNF discuss and assess the feasibility of the participant suggestions that appear throughout this report. Below are some key considerations from each of the major discussion areas: 1) Management 2) Communication and Education, and 3) Collaboration. These key considerations are derived in large part from salient issues that emerged in participant discussions. Follow-up meetings between SNF and the National Center can assist with clarity of what is being recommended.

5.1 Management – Key Considerations

Conversations with assessment participants resulted in the identification of several issues, concerns, and ideas important to specific individuals and interest groups. Section 3 above details participant views on challenges and opportunities to address them. The following sections highlight recommendations derived from the assessment discussions that should be considered by SNF. These include the need for transparency in decision making, following through on stakeholder engagement actions, working closely with Tribes, developing cooperative management approaches, increasing staff-visitor interactions, revisiting the permit system, and improving accessibility of the Wilderness area for underrepresented visitors.

Transparency

Management decisions by the SNF do not appear to be transparent to many participants, and some decisions --like closures or visitor use permit quotas -- felt arbitrary to some people. A participant shared the perception that *"People from DC are making decisions about a place they've never been to or (don't) know. They should be on the ground to understand the types of decisions to make here."*

- Increase transparency by communicating early and often about any changes that will impact cooperators and outfitters, partners, advocacy groups, gateway communities, and local agencies who coordinate with SNF.
- Clarify how Forest Service decisions are made through informal and formal channels of communication, as well as the data utilized to make those decisions, especially to those that issue visitor use permits.

Follow-through

Participants that elected to give their feedback on management issues seemed hopeful that this assessment could bring some change in management practices. However, some invited parties chose not to participate in this assessment due to concerns about how the Forest Service would act on information provided, or doubts that any implementing actions would occur. A few participants shared this perspective, "*From my experience, any concerns or issues that have been voiced from our community to the Forest Service are left unanswered. I have reason to believe this assessment report will be no different. I'm referring to the concerns of outfitters, and also the residents of Ely and surrounding area."*

- Provide more updates via website, social media, and other mediums of communication about management decisions or public engagement opportunities that build on this assessment effort.

Utilize and Incorporate Tribal Knowledges, Worldviews, and Perspectives

The National Center was unable to have conversations with Tribal Nations that have an interest in how the SNF manages the Forest in general, including the BWCAW. SNF invited Tribes to participate in this assessment, but those Tribes determined they would engage the SNF separately. Some tribal representatives shared that Tribal Governments want to ensure that they do not diminish their tribal sovereignty and Government-to-Government consultation requirements by participating in the assessment. Several participants suggested that Tribes should be more involved in BWCAW management. A participant said, *"it is important to me to know how to use the BW in the way that the Tribes have used it."* Another participant stated, *"Spiritual values need to be incorporated into management. We can't intrude too much with our management and should incorporate our values. This management should be led by those who have been there longer."*

The National Center recommends the following:

- Assess the strengths and weaknesses of current communication and coordination with Tribal partners on BWCAW issues specifically.
- Identify areas where coordination might be increased on relevant BWCAW management issues.
- Engage Tribes through established MOUs and/or new Government-to-Government consultation processes.

Increase Cooperative Management Options

Participants suggested SNF should collaborate and partner with key parties on the management of the BWCAW wherever feasible. Participants suggested SNF explore cooperative management opportunities for BWCAW and the Quetico Provincial Park (QPP). Additionally, some participants suggested using agency partners and other interested partners to help maintain the BWCAW.

- Convene a group of Tribal and Forest Service fire management experts to develop a fire management plan.
- Partner with appropriate entities to study the various impacts of invasive species in the BWCAW and/or share information about any work that is currently underway to address this challenge.
- Consider more opportunities to coordinate and/or share best practices and lessons learned with QPP partners and any opportunities to coordinate on joint management issues that involve BWCAW and QPP as a contiguous unit.
- Utilize the National Forest Stewardship Act to deploy volunteers to assist in BWCAW maintenance.

Consider New Ways to Address Visitors Impacts and Improve Relationships with the Wilderness

- The National Center understands that SNF may already be studying visitor behavior and impacts. Participant comments suggest that SNF might update strategies to assess current use patterns throughout the BWCAW to better understand recent visitor types and impacts. Wilderness impacts could be reduced by updating strategies to spread visitors more effectively throughout the BWCAW.
- Consider additional studies/surveys of what people want out of their BWCAW experience.
- Provide additional information in interpretive signage about what is and what is not allowed in the BWCAW.
- Strengthen Leave No Trace Regulations and Enforcement

Increase Staff Interactions with Visitors and Partners

Most participants had positive interactions with locally based staff who they encountered in the BWCAW and on the rest of the SNF. They value those interpersonal encounters.

- Increase SNF field-based staff in the BWCAW, as budgets allow.

- Increase opportunities for coordination and co-learning between SNF wilderness rangers and other staff, along with the public who live in gateway communities.
- Increase visibility of BWCAW staff in busy areas to educate people on Leave No Trace and provide enforcement as needed.

Balance Visitor Use Permit System Needs

A critical question from some parties was, "*How do you provide more equitable access to permits and still manage overcrowding?*" There is a perception that cutting permits and reducing access may improve impacts to campsites, trails, and portages but unfairly limit access to the public or have unequal impacts on businesses that rely on local tourism.

- Share available information/data with visitors and interested groups. to inform people about how and why permit system decisions are made.
- Consider a more nuanced visitor permit system to better distribute visitors away from entry points and prevent overcrowding and related impacts of noise and stress to natural resources.
- Consider ways to lengthen the time allowed for access to permits on recreation.gov (i.e., rolling basis)
- Set aside some permits for underrepresented user groups and local visitors.

Improve Accessibility

- Consider more formal partnerships (MOU, etc.) with organizations that represent diverse underrepresented groups who desire wilderness education and access to the BWCAW.
- Examine the visitor permit system to ensure it does not disadvantage certain user groups, including those with less or no access to fast internet and those for whom English is not a first language.
- Consider reserving some permits for BIPOC and other underrepresented visitors.
- Provide cross-cultural or cultural competency training to field staff.

Create a Forum for Dialogue on Motorboat Uses in the BWCAW

- Create a safe space to discuss various perspectives and to explore possibilities where modifications might be made to management direction, within the existing legislation.

5.2 Communication and Education – Key Considerations

The National Center suggests utilizing the preferred methods of communication for different situations as outlined by participants in Figure 2 on p. 26. Additionally, consider participants' needs for the following:

Consider New Materials and Platforms

- Where possible, produce more up-to-date videos and online material; develop creative messaging to reach and capture the attention of younger generations of visitors who might be using the BWCAW more and creating the most impact.
- Develop additional targeted education materials for different types of visitors such as the casual user, motorboat users, non-motorized boaters (kayakers, canoers, etc.), and stand-up paddlers.

Expand the Narrative of the BWCAW

- Develop interpretation materials and signage that promotes the idea of wilderness that is deeper than recreation (for example, cultural uses, more integrative understanding of the sacredness of these lands and waters, and highlights the area's historical, cultural and religious/spiritual significance to Anishinaabe peoples).
- Create additional educational materials to more effectively prepare visitors to experience and respect the Wilderness area.

Campsites and Trails

- Communicate and update visitors on BWCAW priorities and maintenance activities via newsletters and social media.
- Educate visitors about alternative routes and under-utilized campsites within the BWCAW.
- Educate visitors about areas outside the BWCAW that provide similar opportunities and are easier to access.
- Establish an online system that allows visitors to provide feedback or alert SNF to visually indicate where there are maintenance needs.

5.3 Collaboration – Key Considerations

Most participants were excited or hopeful about the idea of more engagement with SNF staff and other parties. As highlighted in the Collaboration section above, many noted that they would be interested in participating in a collaborative process if it was well organized, could address specific topics, represented diverse interests, and was sensitive participants' time constraints. Needs for participation outlined by participants are covered in the Collaboration section of the report. Below are suggestions that relate to the structure of a group and considerations related to individual meetings:

Structure of a Collaborative Engagement Process

All participants felt any collaborative effort must be built around a compelling mission, purpose, and vision for engagement. It will be important to design a process with clear guidelines and clarity of roles for those involved. It will also be critical to have some SNF decisionmakers in the room to hear and learn directly from various participants. Participants want to ensure that decision-making authority on various issues is clear to them, even if the collaborative group is not a decision-making body. There should be an established feedback loop between SNF and participants on how input informs decision-making, including when work that arises from collaborative engagement is not utilized. SNF should also clarify Forest Service policies, mandates, and jurisdictions and how those impact current management.

The National Center recommends SNF be thoughtful and deliberate about diverse representation in any collaborative effort. Participation should be adequate and inclusive of various BWCAW interests and should include opportunities for participation of local and regionally interested parties as well as visitors from outside the region. Invite Tribal Governments to be part of any collaborative process even if they choose to engage in other ways. Following are additional suggestions that were central in the participant dialogues:

- Consider different terms for the group other than 'collaborative' (example: advisory committee, dialogue group, etc.).
- Consider utilizing a set of focus groups or sub-committees.
    - Have appropriate interested parties and subject matter experts at the table to tackle specific topics.
    - Sub-committees might focus on specific priorities related to management of the BWCAW, including communication, and education.
- Clarify the relationship to Federal Advisory Committee Act (FACA) and determine if it will apply to the process.
- Provide an official invitation to those invited to join a collaborative group so that it can be included in their job description to ensure that people can fully commit to the effort.

Meetings

Based on participant input, a collaborative group should meet consistently but be sensitive to the time demands on individuals and organizations. Regular meetings might be most effective on a quarterly basis but seek to avoid peak tourist season. Standing meetings that people can plan to attend will help improve turnout. Seek to design in-person meetings where relationship building can be paramount but allow for a hybrid option to accommodate the realities of vast regional participation and competing priorities. Collaboratively build meeting agendas with participants to ensure co-creation of focus areas. This will ensure that agenda topics are meaningful to both SNF and all other participants. Lastly, participants often suggested that it will be important to focus on the issues that can be dealt with outside of legislation (within the scope of existing legislation).

5.4 Concluding Remarks

The National Center for Environmental Conflict Resolution recommends Superior National Forest move forward with forming a collaborative group or other forms of sustained engagement to strengthen communication and to better coordinate on specific issues that might benefit from shared learning. The National Center has presented the results of the assessment to the SNF Steering Committee and SNF Forest Leadership Team to determine next steps. Based on the results of this assessment, SNF is now considering the scope, scale, and budget needed to convene a collaborative effort with a diverse cross-section of partners, stakeholders, and other interested parties. The National Center will be working with SNF to design a path forward and to advise SNF on what might be needed to convene a formal collaborative group.

APPENDIX A – ASSESSMENT PARTICIPANTS

Participant Affiliation	Participant Name
Adventurous Christians	Matt White
Aldo Leopold Wilderness Research Institute	Jason Taylor
Aldo Leopold Wilderness Research Institute	Lauren Redmore
Big City Mountaineers	Fred Sproat
BIPOC Outdoors Twin Cities	Asha Shoffner
Border Route Trail Association	Gary Carlson
Boundary Waters Advisory Committee	Rod Markin
BW Activist and Historian	Chuck Dayton
BWCAW Coalition	Carrie Ohly-Cusack
BWCAW User	Justin A.
BWCAW User	Francis Beloy
BWCAW User	Aaron Bergsma
BWCAW User	Marcy Byrns
BWCAW User	Sara Citrowske
BWCAW User	Leonard Clewett
BWCAW User	Dean Cooper
BWCAW User	Carol DeSain
BWCAW User	Patrick Fay
BWCAW User	Mark Flom
BWCAW User	Lynden Gerdes
BWCAW User	Jennifer Greenberg
BWCAW User	Elizabeth Jefferson
BWCAW User	Anonymous
BWCAW User	Michael Kennedy
BWCAW User	Kent Olson
BWCAW User	Aaron Onsrud
BWCAW User	Steve Perunovich
BWCAW User	Paul Schlueter
Camp Mishawaka	Stephen Purdum
Canada Border Services	Kim Beaudry
Central Michigan University	Bob Dvorak
Conservationists with Common Sense	Nancy McReady
Cook County	James Joerke
Cook County Sheriff Office	Pat Eliasen
Custom Cabin Rental	Willy Vosburgh
Duluth County	Phil Jents
Ely County	Roger Skraba
Ely Community Resource	Julie Hignell
Ely Fishing Guide Company	Rob Nelson
Ely Outfitting	Jason Zabokrtsky

Participant Affiliation	Participant Name
Friends of the BWCAW	Max Kieley
Friends of the BWCAW	Chris Knopf
Friends of the BWCAW	Scott Beauchamp
Friends of the BWCAW	Ozzie Reif
Girl Scouts of MN & WI Lakes and Pines	Melissa Garza
Girl Scouts of MN & WI Lakes and Pines	Ann McNally
Grand Portage National Monument	William Clayton
Gunflint Northwoods Outfitters	John Fredrickson
Hauling Dogs LLC	Shawn McCarty
Hungry Jack Canoe Outfitters	David Seaton
Jasper Company	Don Beans
Lake County Sheriff Office	Nathan Stadler
Lake County Sheriff Office	Timothy Luoma
Lake Vermilion Resort and Tourism Association	Dan Debano
LaTourell's Resort & Outfitters	Bob LaTourell
Listening Point Foundation	Steffi O'Brien
MN Department of Natural Resources	Shelly Patten
North Country Canoe Outfitters	John Schiefelbein
North Country Trail Association	Matt Davis
Northeastern Minnesotans for Wilderness	Becky Rom
Northeastern Minnesotans for Wilderness	Ingrid Lyons
Northeastern Minnesotans for Wilderness	Matt Norton
Northern Tier BSA	Blake Ferree
Outdoor Afro	Stephen Scott
Piragis Northwoods Company	Drew Brockett
Prior Forest Service Employee	Steve Cochran
Prior Forest Service Employee	Barbara Soderberg
Quetico Provincial Park	Trevor Gibb
Sawbill Canoe Outfitters	Clare Shirley
Sawbill Canoe Outfitters	Dan Shirley
Seagull Canoe Outfitters	Deb Mark
Sigurd Olson Environmental Institute - Northland College	Alan Brew
Snowbank Lodge and Outfitters	Adam Jensen
Society for Wilderness Stewardship - Midwest region	Julia Cotter
Spirit of the Wilderness Outfitters	Ginny Nelson
Sportsmen for the Boundary Waters	Bob St. Pierre
St Louis County Sheriff Office	Jason Akerson
St. Louis County	Paul McDonald
Stone Harbor Wilderness Supply	Annika Truebenbach
The Nature Conservancy - Minnesota/Canada	Ann Mulholland
Timber Trail Lodge & Outfitters	Peter Kostantacos
Tuscarora Outfitters	Ada Igoe
Tuscarora Outfitters	Andy McDonnell
University of Minnesota	Lee Frelich
University of Minnesota Boreal Forest and Community Resilience	Ingrid Schneider

Participant Affiliation	Participant Name
Project	
University of Minnesota Boreal Forest and Community Resilience Project	Mae Davenport
US Customs and Border Protection	Erich Rohr
Virginia Tech	Joe Roggenbuck
Visit Cook County	Linda Jurek
Visit Cook County	Kjersti Vick
Voyageur Canoe Outfitters	Matt Ritter
Voyageur Canoe Outfitters	Mike Prom
Voyageurs National Park	Bob Degross
Wilderness Inquiry	Cyri Tjaden
Wilderness Watch and BWCAW Historian	Kevin Proescholdt
Wolf Ridge Environmental Learning Center	Peter Smerud
Women's Wilderness Discovery	Peta Barrett
YMCA Camp Menogyn	Meghan Cosgrove
YMCA Camp Menogyn	Brent Saxton
YMCA Camp Widjiwagan	Matt Poppleton

APPENDIX B – DISCUSSION GUIDE

Discussion Guide - Boundary Waters Canoe Area Wilderness Assessment

Introduction

The U.S. Forest Service (Forest Service) Superior National Forest (SNF) is working with the National Center for Environmental Conflict Resolution (National Center), a program of the Udall Foundation, to conduct an independent, neutral situation assessment to gather input from a broad range of individuals and groups with interests in recreation, advocacy, or commercial use that live nearby, work in, and visit the Boundary Waters Canoe Area Wilderness (BWCAW) . The assessment will help SNF identify diverse areas of concern by those interested in the management of the BWCAW. The assessment discussions will also explore the possibilities of forming a public engagement process for interested parties or other forms of sustained engagement between the Forest Service and parties interested in the management of the Wilderness area. The SNF leadership believes a public engagement effort with interested parties can help improve communication of wilderness management principles and decisions, while also allowing people to engage with different viewpoints in a facilitated and cooperative environment. Determination of next steps and further engagement will be made based on outcomes of these assessment and later discussions with SNF.

Goals of Assessment

The goals of the assessment discussions are to:

- Learn about current issues, interests, and concerns from interested parties related to the management of the BWCAW. (Tribes, Stakeholders, Partners)
- Gather ideas on the formation of a SNF-led public engagement effort that would consist of a diverse cross-section of parties interested in the BWCAW.
- Identify key parties who would like to engage at various levels (meetings, calls, etc.)
- Identify barriers to participation and suggestions for an effective engagement process.

Background

The Boundary Waters Canoe Area Wilderness is one of the largest, oldest, and most legislatively complex, heavily marketed and visited federally designated wilderness areas in the nation. Within the last five years, the BWCAW had an annual average of approximately 150,000 visitors. Complex wilderness management decisions often necessitate the need for periodic communication assessments between all interested parties to ensure a greater shared understanding of management complexities. In 2022, the Superior National Forest researched opportunities for public engagement assistance concerning BWCAW issues and contacted the National Center for Environmental Conflict Resolution.

The National Center is a program of the Morris K. Udall and Stewart L. Udall Foundation, an independent, nonpartisan Federal agency of the Executive Branch. The National Center provides collaboration, consensus-building, and conflict resolution services on a range of environmental, natural, and cultural resources, Tribal, and public lands issues involving the Federal Government. In more than 20 years of operation, the National Center has provided neutral and impartial assistance on over 650 projects across the country. The facilitation, mediation, assessment, and capacity building services provided by the National Center support public and stakeholder participation in Federal programs and

projects as well as engagement with agency partners while improving decision-making, increasing efficiencies through timely project implementation, improving communication and relationships, and offering more durable and implementable outcomes.[3]

The National Center for Environmental Conflict Resolution Facilitation Team conducting the discussions includes Seth Cohen, Melanie Knapp, and Courtney Owen.

Steering Committee Members

The National Center is working with a Steering Team comprised of members of SNF to plan and conduct this assessment. SNF staff will not be present in the discussions, but they will receive a summary of the assessment results without attribution of discussion participants (see Confidentiality below).

Discussion Logistics

Due to COVID-19, discussions will be conducted virtually via phone, Microsoft Teams, or Zoom. Individual discussions will be one hour. Focus group discussions will be 1.5 hours. Discussions will not be recorded (see below for additional details).

Confidentiality

These discussions are confidential. The National Center will summarize insights from these discussions without attribution. The National Center will capture notes from these discussions and do everything legally possible to honor that confidentiality. Notes from discussions are used for internal use **only** by National Center staff. The National Center will share compiled results of the discussions with the Superior National Forest Team and participants. The National Center will include a list of all individuals that participated and their affiliations in an appendix to the results.

Results of the Assessment

Following the discussions, the National Center will compile the information, prepare an analysis of the range of views from the participants, and results of the assessment will be shared with participants for review and comment. We will then revise the compilation document as appropriate and present it as discussion themes and opportunities. Utilizing the assessment results, the National Center will work with the SNF steering committee to develop recommendations and provide support to consider next steps for engagement with BWCAW parties.

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[3] Additional information about the National Center is available at: www.udall.gov.

Assessment Discussion Questions

1. Please tell us a little about your background and your (or your organization's) association with the Boundary Waters Canoe Area Wilderness (BWCAW)? Why is the BWCAW important to you?
2. What do you see as the most pressing wilderness management issues, topics, or challenges that need to be addressed in the BWCAW?
3. Any thoughts or suggestions on how to improve the management of this designated wilderness?
4. Can you describe an example of coordination or communication efforts with the Forest Service on BWCAW management issues that worked well in the past and didn't work well in the past? What do you wish had been handled differently and how?
5. What is your preferred way to receive and provide information about the BWCAW with the Forest Service?
6. What are your thoughts about the Superior NF setting up a collaborative group or other form of sustained engagement that allows for multi-party dialogue on wildness management issues?
    a. What would help make a collaborative process successful?
    b. Would you /your organization or agency be interested in participating in a collaborative process with the Forest Service and other interested parties?
    c. What would you/ your organization or agency need to participate in a collaborative process (examples: ethics review, official invitation, ground rules/working agreement, group norms; working charter, etc.)?
    d. Would you have any concerns about staying involved in a collaborative process (examples: meeting frequency, logistics, location etc.)? Do you see any barriers that would need to be addressed?
7. Are there other interested parties you have strong relationships with on BWCAW issues or who you feel represent your viewpoints on wilderness management issues. Please share any of these organizations or individuals that you feel should be considered for future collaborative efforts.
8. Is there anything else that you would like to add that we have not discussed?